WOMEN IN SCIENCE AND TECHNOLOGY EQUAL OPPORTUNITY ACT, 1980

HEARING

BEFORE THE

SUBCOMMITTEE ON HEALTH AND SCIENTIFIC RESEARCH

OF THE

COMMITTEE ON LABOR AND HUMAN RESOURCES UNITED STATES SENATE

NINETY-SIXTH CONGRESS

SECOND SESSION

ON

S. 568

TO PROMOTE THE FULL USE OF HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY THROUGH A COMPREHENSIVE PROGRAM TO MAXIMIZE THE POTENTIAL CONTRIBUTION AND ADVANCEMENT OF WOMEN IN SCIENTIFIC, PROFESSIONAL, AND TECHNICAL CAREERS

MARCH 3, 1980

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CONTENTS

Text of: Page
Committee Print of S. 568 2

CHRONOLOGICAL LIST OF WITNESSES

MONDAY, MARCH 3, 1980

Vetter, Betty M., executive director, Scientific Manpower Commission 12
Pimentel, Dr. George, Deputy Director, National Science Foundation, accompanied by Dr. James Rutherford, assistant director, science education 25
Reynolds, Dr. Ann, provost, Ohio State University; Dr. Shirley Mahaley Malcom, director, Office of Opportunities in Science of the American Association for the Advancement of Science; Ms. Margaret Dunkle, president, Federation of Organizations for Professional Women; and Dr. Mary Kostalos, codirector, women in science career facilitation program, Chatham College, a panel 40

STATEMENTS

American Physical Society, Herman Feshbach, president, prepared statement. 219
Association for Women in Science, prepared statement 213
Department for Professional Employees, AFL-CIO, R. W. Hackler, co-chair and Gloria Johnson, co-chair, Salaried and Professional Women's Committee, prepared statement (with attachment) 225
Federation of Organizations for Professional Women, Margaret C. Dunkel, president, prepared statement 53
Kostalos, Dr. Mary, codirector, women in science career facilitation program, Chatham College, prepared statement 189
Pimentel, Dr. George, Deputy Director, National Science Foundation, accompanied by Dr. James Rutherford, assistant director, science education 25
Prepared statement 29
Reynolds, Dr. Ann, provost, Ohio State University; Dr. Shirley Mahaley Malcom, director, Office of Opportunities in Science of the American Association for the Advancement of Science; Ms. Margaret Dunkle, president, Federation of Organizations for Professional Women; and Dr. Mary Kostalos, codirector, women in science career facilitation program, Chatham College, a panel 40
Prepared statement 43
Schafer, Alice T., Helen Day Gould, professor of mathematics, chair, AMS-MAA-NCTM-SIAM Committee on Women in Mathematics, prepared statement 234
Vetter, Betty M., executive director, Scientific Manpower Commission 12
Prepared statement 14
Women's College Coalition, Marcia K. Sharp, director, prepared statement 204

ADDITIONAL INFORMATION

Articles, publications, etc.—Continued
Baccalaureate Origins of American Scientists and Scholars, by M. Elizabeth Tidball and Vera Kistiakowsky, from Science, vol. 193, pp. 646-652, August 20, 1976 134
Information regarding the employment of women at the National Institutes of Health 142
Report of the Women's College Coalition survey of biomedical research activity in undergraduate women's colleges 73

Articles, publications, etc.—Continued

Page

Specific comments and suggestions regarding S. 568, the Women in Science and Technology Equal Opportunity Act, from the Federation of Organizations for Professional Women 62

Women Scientists in Industry and Government: How Much Progress in the 1970's? National Academy of Sciences, interim report to the Office of Science and Technological Policy, from the Committee on the Education and Employment of Women in Science and Engineering, 1980 74

WOMEN IN SCIENCE AND TECHNOLOGY EQUAL OPPORTUNITY ACT, 1980

MONDAY, MARCH 3, 1980

U.S. SENATE,
SUBCOMMITTEE ON HEALTH AND SCIENTIFIC RESEARCH,
COMMITTEE ON LABOR AND HUMAN RESOURCES,
Washington, D.C.

The subcommittee met, pursuant to notice, in room 2228, Dirksen Senate Office Building, Washington, D.C., commencing at 10:08 a.m., Senator Howard M. Metzenbaum, presiding, pro tempore.

Present: Senators Metzenbaum and Schweiker.

Staff present: Rhonda B. Friedman, Robert Wenger, Robert Knouss, and Polly Gault.

Senator METZENBAUM. Today the Subcommittee on Health and Scientific Research will conduct its second day of hearings on S. 568, the Women in Science and Technology Equal Opportunity Act. I am pleased to be able to take the chair in Senator Kennedy's absence.

Women have been excluded by educational, institutional, and cultural barriers in many areas of our national life, but nowhere is that exclusion more obvious than in science and technology. Today, fewer than 3 percent of the Nation's engineers, 4 percent of our physicists, and 11 percent of our chemists are women. If those figures could somehow be improved by 10 percent per year, it would still take nearly half a century for women to reach full equality in these fields.

Conventional wisdom has it that talented women now have opportunities in education and employment that were not easily available to their mothers and grandmothers. But as we will hear from today's witnesses, that certainly is not the case in science and technology. Today the unemployment rate for women scientists is two to five times higher than the rate for men in every field of science. Generally, women scientists earn less than men in every field, at every degree level, at every level of experience, and in every employment setting.

In 1973 doctoral scientists and engineers who were women earned nearly 17 percent less than their male colleagues. That gap passed the 20-percent mark in 1977. In our colleges and universities women faculty members continue to advance less rapidly and to receive tenure less frequently than their male colleagues.

This situation is unjust, and it also represents an enormous and intolerable waste of this Nation's most precious resource, which is the talent and human potential of its people.

The legislation that we will be considering today is designed to overcome some of the impediments that have discouraged so many able women in pursuing careers in science and engineering. It includes programs to increase the number of employment and research opportunities for women scientists. It provides funding to the National Science Foundation at the elementary, secondary, and college levels, to encourage and prepare women to pursue careers in science. It authorizes information programs to help women enter and advance in scientific and technical careers. It establishes programs for increased public understanding of the opportunities for women in science, and it calls for data collection and reporting procedures to measure progress in achieving greater participation.

Today we will hear from Betty Vetter, executive director of the Scientific Manpower Commission, who will describe the current status of women in science.

Dr. George Pimentel, Deputy Director of the National Science Foundation, will discuss the Foundation's current activities related to women in science and the issues that S. 568 addresses.

We will hear from a panel consisting of Dr. Ann Reynolds, provost of Ohio State University, Dr. Shirley Malcom, of the American Association for the Advancement of Science, Margaret Dunkle of the Federation of Organizations for Professional Women, and Dr. Mary Kostalos, who directs the women in science career facilitation program at Chatham College in Pennsylvania.

We know that Federal legislation alone will not change the patterns whose origins are very complex, but Federal effort in this area can, I believe, help create a new commitment on the part of the scientific community, educators, and employers, to make a reality of the promises that we as a Nation have made to provide equal opportunity for all.

[The text of the Committee Print of S. 568, follows:]

[COMMITTEE PRINT]

JANUARY 25, 1980

[96th Cong., 2d Session]

S. 568 To promote the full use of human resources in science and technology through a comprehensive program to maximize the potential contribution and advancement of women in scientific, professional, and technical careers.

IN THE SENATE OF THE UNITED STATES

March 7 (legislative day, February 22), 1979

Mr. Kennedy introduced the following bill; which was read twice and referred to the Committee on Human Resources

[Strike out all after the enacting clause and insert the part printed in italic]

[For text of introduced bill, see copy of bill as introduced March 7, 1979]

A BILL To promote the full use of human resources in science and technology through a comprehensive program to maximize the potential contribution and advancement of women in scientific, professonal, and technical careers.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Women in Science and Technology Equal Opportunity Act".

TITLE I—STATEMENT OF FINDINGS, PURPOSE, AND POLICY

STATEMENT OF FINDINGS

Sec. 101. The Congress finds that—

(1) it is in the national interest to promote the full use of human resources in science and technology and to insure the full development and use of the talents of men and women with scientific and technical skills;

(2) the preeminent position of the Nation in science and technology depends upon the development of the full potential of the talents of men and women with scientific and technological skills, and the full employment of such men and women produces job opportunities in technical and support occupations and exerts a strong multiplier effect on the gross national product;

(3) the full use of the scientific and technical human resources of the Nation is required to meet the strong demand for such resources over the long term;

(4) skills in science and mathematics are essential for entry and achievement in a wide range of professional and technical fields;

(5) literacy in science and mathematics contributes importantly to the ability of the individual to function in a wide range of activities;

(6) women have long been denied equal educational and employment opportunities in scientific and technical fields; and

(7) although men and women have equal potential for excellence and advancement in scientific and technical fields—

(A) the proportion of women earning doctoral degrees in science in the decade of the 1970s is no greater than the proportion of women earning such degrees in the decade of the 1920s;

(B) less than 10 percent of scientists and engineers engaged in research are women;

(C) the unemployment rates of women scientists are three times higher than such rates for men in every field of science, and are five times higher among young doctorates;

(D) women scientists generally earn less than men in every field, at every degree level, at every level of experience and in every employment setting;

(E) minority women have yet to achieve measurable participation in science; and

(F) handicapped women have yet to achieve measurable participation in science.

DECLARATION OF PURPOSE

Sec. 102. It is the purpose of this Act to encourage the full participation of women in scientific, engineering, professional, and technical fields through programs and procedures which—

(1) prepare women for scientific, engineering, professional, and technical careers;

(2) increase opportunities for the employment and advancement of women in science and technology;

(3) improve the science education of women, with particular emphasis on mathematics education;

(4) promote the literacy of women in science and mathematics;

(5) encourage the participation of minority women in scientific and technical education and careers;

(6) encourage the participation of handicapped women in scientific and technical education and careers; and

(7) educate and inform the public concerning the importance of the participation of women in science and technology.

STATEMENT OF POLICY

Sec. 103. The Congress declares it is the policy of the United States to encourage women to acquire skills in science and mathematics, to assure equal opportunity for women in education, training, and employment in scientific and technical fields, and thereby to promote scientific literacy and the full use of the human resources of the Nation in science and technology. Activities conducted to carry out the purposes and provisions of this Act shall—

(1) be carried out under the direction of the National Science Foundation;

(2) make maximum use of existing Federal programs, funding, and reporting procedures;

(3) provide for full coordination between all Federal agencies involved in carrying out the provisions of this Act

(4) use the expertise of women scientists and women involved in scientific activities;

(5) provide for the participation of professional associations and groups with expertise in the advancement of women, especially associations and groups involved in the advancement of women in science and technology;

(6) encourage the involvement in and contribution of resources for scientific activities by the private sector;

(7) encourage opportunities for accomplishing comprehensive and long-term institutional change relating to the participation of women in science;

(8) emphasize fields of scientific and technical study and employment in which the underrepresentation of women is most serious and in which existing public and private activities are insufficient; and

(9) provide for and encourage cooperation between the industrial and academic sectors in accomplishing the purposes of this Act.

DEFINITIONS

Sec. 104. For the purposes of this Act—

(1) the term "Federal agency" means an agency as defined in section 551(1) of title 5, United States Code;

(2) the term "State" means each of the several States and the District of Columbia;

(3) the term "Foundation" means the National Science Foundation;

(4) the term "Director" means the Director of the Foundation;

(5) the term "Center" means the Center for Women in Science established under section 301; and

(6) the term "Committee" means the Committee on Women in Science established under section 501.

TITLE II—EDUCATION

ELEMENTARY AND SECONDARY EDUCATION PROGRAMS

Sec. 201. (a) The Foundation is authorized, after consultation with appropriate public agencies and private entities, to support, by way of grant or contract, activities designed to strengthen elementary and secondary school programs in science and mathematics.

(b) Activities supported under this section shall emphasize the acquisition of knowledge, skills, and information by female students, and shall include—

(1) the development of methods, instructional materials, and technologies to improve the quality and relevance of education in science and mathematics and to increase student awareness of career opportunities requiring scientific and technical skills;

(2) the training and retraining (including inservice training) of teachers, counselors, administrators, and other appropriate educational personnel to improve the quality and relevance of education in science and mathematics and to increase student awareness of career opportunities requiring scientific and technical skills;

(3) the use of innovative methods, systems, materials, visiting women scientists and technicians, or other arrangements to encourage students to continue in and complete courses in science and mathematics and to consider careers in scientific and technical fields;

(4) student science training programs, research participation projects, and internships; or

(5) workshops for students and their parents and guardians to increase awareness and understanding of the importance of skills in science and mathematics and of the extent to which scientific and technical skills are required for entry into careers.

(c) The Foundation shall coordinate activities under this section with similar activities of appropriate public agencies and private entities.

HIGHER EDUCATION PROGRAMS

Sec. 202. (a) The Foundation is authorized, after consultation with appropriate public agencies and private entities, to support, by way of grant or contract, activities which demonstrate potential to (1) increase the participation of women in courses of study leading to degrees in scientific and technical fields, (2) encourage women to

consider and prepare for careers in science, engineering, and technology, (3) provide traineeship and fellowship opportunities for women in science and technology, or (4) provide continuing education opportunities in science and technology for women whose careers have been interrupted.

(b) Activities supported under this section shall include—

(1) the development of technologies, methods, and instructional materials at the undergraduate level to strengthen skills in science and mathematics and to increase student awareness of career opportunities requiring scientific and technical skills;

(2) the training and retraining (including inservice training) of faculty, counselors, administrators, and other appropriate personnel at the undergraduate level to improve the ability of such personnel to (A) strengthen the skills in science and mathematics of students whose primary field of study is not scientific or technical, (B) increase student awareness of career opportunities for women in science, particularly in the fields in which women are most seriously underrepresented, and (C) increase student awareness of career opportunities for women requiring basic scientific and technical skills;

(3) the awarding of graduate and postgraduate fellowships, and career development grants, directly to individuals and to institutions for award to individuals, without regard to when the individual received an undergraduate degree;

(4) research participation, traineeships, work study, and internship programs; or

(5) projects to encourage individuals interested in scientific and technical fields to continue in and complete courses of study leading to degrees in such fields.

(c) The Foundation shall coordinate activities under this section with similar activities of appropriate public agencies and private entities.

(d) Individual recipients of fellowships, grants, and traineeships under this section shall be paid such stipends (including such allowances for subsistence, health insurance, relocation expenses, and other expenses for such recipients and their dependents) as the Director may prescribe.

CONTINUING EDUCATION PROGRAM

Sec. 203. (a) The Foundation, after consultation with appropriate public agencies and private entities, is authorized to support, by way of grant or contract, activities in continuing education in science and engineering which provide opportunities for women who (1) are in the work force, or (2) who are not in the work force because their careers have been interrupted, to acquire new knowledge, techniques, and skills in scientific and technical fields.

(b) Activities supported under this section shall include—

(1) the development of curricula, educational techniques, and recruitment activities in cooperation with industry and academic institutions for continuing education in science and technology;

(2) the award of full-time and part-time fellowships to enable individuals eligible under subsection (a) to pursue courses of study which provide continuing education in science and technology, without regard to when the individual received an undergraduate degree; and

(3) other activities, including pilot programs and regional efforts, to further the purposes of this section.

(c) Individual recipients of fellowships under this section shall be paid such stipends (including such allowances for subsistence, health insurance, relocation expenses, and other expenses for such individuals and their dependents) as the Director may prescribe.

TECHNICAL ASSISTANCE

Sec. 204. In carrying out this title, the Foundation is authorized to make available necessary technical assistance.

TITLE III—PUBLIC UNDERSTANDING

Part A—Activities and Programs

CENTER FOR WOMEN IN SCIENCE

Sec. 301. (a) After consultation with groups active in the promotion of increased opportunities for women in science and other appropriate public agencies and private

entities, the Foundation shall establish, directly or by contract, a Center for Women in Science.

(b) The Center, in cooperation with groups active in the promotion of increased opportunities for women in science and other appropriate public agencies and private entities, shall undertake and support activities designed to—

(1) educate and inform the public concerning the importance of the participation of women in science and technology;

(2) alleviate discrimination against women in science and technology; and

(3) encourage the education, employment, and advancement of women in science and technology.

(c) The Center shall collect, analyze, and disseminate to the public information concerning activities in the public and private sectors which encourage the full participation of women in science and technology. Such information shall include—

(1) activities to encourage the advancement of women in science;

(2) activities to assure equal opportunity for women in science and technology;

(3) activities to improve science education and promote literacy in science and mathematics;

(4) opportunities for minority women in scientific and technical careers;

(5) opportunities for handicapped women in scientific and technical careers;

(6) data on the status and number of women in scientific and technological positions;

(7) research being conducted to increase the contribution of women in science and technology and to facilitate the participation and advancement of women in scientific and technological careers, and the results of such research; and

(8) activities to educate and inform the public concerning the importance of the participation of women in science and technology.

RESEARCH PROGRAM

Sec. 302. (a) The Director is authorized to undertake or support, by way of grant or contract, a comprehensive research program designed to increase understanding of (1) the potential contribution of women in science and technology and (2) the means to facilitate the participation and advancement of women in scientific and technical careers.

(b) The program shall include studies concerning the problems confronting girls and women in the study of science and mathematics, and the impact of science and mathematics skills on the entry and advancement of women in nonscientific fields.

DISSEMINATION

Sec. 303. Data collected and the results of research and demonstrations conducted under this Act shall be made available to the public through appropriate dissemination mechanisms, including the Center.

MEDIA PROJECTS

Sec. 304. (a) The Foundation is authorized to support, by way of grant or contract, activities designed to improve the scope, relevance, and quality of information available to the public concerning the important of the participation of women in careers in science and technology through the use of radio, television, journals, newspapers, magazines, and other media.

(b) Activities supported under subsection (a) shall—

(1) demonstrate potential for increasing public awareness of the contribution of women in scientific and technical fields;

(2) stress the importance of equal opportunity for women in careers in science and technology;

(3) emphasize the importance of skills in mathematics and science for a wide range of activities and programs; or

(4) include new media or information techniques with the potential to further the purposes of this section.

BOOKS AND INSTRUCTIONAL MATERIALS

Sec. 305. The Foundation, after consultation with appropriate public agencies and private entities, is authorized, by way of grant or contract, to support the development of books and instructional materials and the identification of existing books and instructional materials which—

(1) portray women in scientific and technical careers;

(2) encourage girls and women to consider careers in science and technology;

(3) emphasize the need for mathematical and technical skills in a wide range of activities and professions;

(4) present scientific and technical material in a manner which is not biased on the basis of gender;

(5) emphasize the equal ability and status of men and women in science and technology; or

(6) stress the importance of equal opportunity for women in science and technology.

COMMUNITY OUTREACH

Sec. 306. The Foundation is authorized to support, by way of grant or contract, community outreach activities which have the potential to attract substantial numbers of girls and women and which are designed to—

(1) emphasize the importance of equal opportunity in scientific and technical fields;

(2) stimulate the interest of girls and women in science and mathematics; or

(3) encourage girls and women to continue in and complete courses of study in science and mathematics.

MUSEUM PROGRAMS

Sec. 307. The Foundation is authorized to support, by way of grant or contract, activities of museums and science centers which demonstrate potential to interest and involve women. Activities supported under this section shall encourage the study and development of skills in mathematics and science, emphasize opportunities for careers in scientific and technical fields, and stress the importance of equal opportunity for women in science and technology.

Part B—Awards

DISTINGUISHED ACHIEVEMENT IN THE ADVANCEMENT OF WOMEN IN SCIENCE AWARD

Sec. 311. The Director, upon the recommendations of the Committee, is authorized to make no more than twenty awards, to be known as the Distinguished Achievement in the Advancement of Women in Science Awards. Such awards may be made to individuals (without regard to gender), academic institutions, State or local public agencies, private nonprofit organizations, or business concerns that have made outstanding contributions to the participation and advancement of women in science and technology.

MATHEMATICS AND SCIENCE INCENTIVE AWARDS

Sec. 312. (a) The Director, upon the recommendations of the Committee, is authorized to make no more than twenty cash awards of $10,000 each, to be known as the Mathematics and Science Incentive Awards, to schools which include one or more of grades seven through twelve and which have demonstrated a commitment to encouraging the enrollment of girls and young women in mathematics and science courses. Schools which have demonstrated, over a period of at least three years, a substantial increase in the number of women enrolled in mathematics and science courses or which enroll substantially more than the national average of women in advanced mathematics and science courses shall be eligible for awards under this section.

(b) Cash awarded under subsection (a) shall be used by the recipients to establish or further programs which encourage the participation of women in mathematical and scientific careers.

VISITING WOMEN SCIENTISTS PROGRAM

Sec. 313. (a) The Director is authorized to establish a visiting women scientists program.

(b) Each year, the Director, upon the recommendation of the Committee, is authorized to name not fewer than thirty women from a wide range of disciplines and geographical areas who work in the Government, private, and academic sectors to be visiting women scientists. At least one-half of the visiting women scientists named in a particular calendar year shall be women who have degrees in science and engineering which were conferred during the five-year period immediately preceding the date of their selection.

(c) Visiting women scientists named under subsection (b) shall visit secondary schools and institutions of higher education in all regions of the country in order to—

(1) encourage girls and women to acquire skills in mathematics and science;

(2) encourage girls and women to consider careers in science and engineering and to prepare themselves appropriately for such careers; and

(3) conduct lectures, seminars, informal discussions, and workshops concerning various aspects of scientific and technical careers for women.

(d) Each visiting woman scientist who is not otherwise employed by the United States Government shall receive compensation at a rate equal to the daily rate prescribed for GS-18 under the General Schedule under section 5332 of title 5, United States Code, for each day, including traveltime, she is engaged in the actual performance of her duties under this section. A visiting woman scientist who is an officer or employee of the United States Government shall serve without additional compensation. Each visiting scientist shall be reimbursed for travel, subsistence, and other necessary expenses incurred by her in the peformance of her duties.

TITLE IV—REPORTING, DATA COLLECTION, AND DEMONSTRATION PROJECTS

Part A—Agency Responsibility

DEFINITIONS

Sec. 401. (a) For purposes of this title—

(1) the term "Federal financial assistance" means any grant, loan, or contract other than a contract of insurance or guaranty;

(2) the term "national laboratory" means any Government directerd research and development laboratory, as well as any research and development laboratory funded at least in part by the Federal Government, except as provided in paragraph (3) of this subsection; and

(3) the term "federally funded research and development center" means any organization which performs research and development exclusively or substantially financed by the Federal Government and which is administered by an industrial firm, university, college, or other nonprofit institution.

(b) The Director of the Office of Science and Technology Policy, in consultation with the Director, the Director of the Office of Personnel Management, and the Director of the Office of Management and Budget, shall establish the criteria for defining "scientific, technological, and technical positions" for the purposes of this title.

REPORTING REQUIRED AND DATA COLLECTION

Sec. 402. (a) By September 30 of each year, the Chairman of the Equal Employment Opportunity Commission shall prepare and transmit to the Foundation a report concerning the employment status of women in scientific and technical fields. to the maximum extent possible, the Chairman shall collect such information through existing appropriate data collection mechanisms and reporting procedures.

(b) The report required by subsection (a) shall include—

(1) for all employers with fifteen or more employees who employ individuals from scientific and technical fields and for each Federal agency that conducts or supports research and development in science and technology, a complilation, comparison, and evaluation, by gender and discipline, of—

(A) the number of individuals in permanent and temporary and in full-time and part-time scientific and technical positions, by GS level or other similar category;

(B) the average salary of individuals employed in such scientific and technical positions, by GS level or other similar category;

(C) the number and type of promotional opportunities realized by individuals in such scientific and technological positions;

(D) the number of individuals serving on peer review and advisory panels dealing with scientific research and development activities; and

(E) the number of individuals serving as principal investigators in Federal agency, national laboratory, or federally funded research and development center supported or conducted scientific research and development projects; and

(2) for each Federal agency, national laboratory, or federally funded research and development center, a description and evaluation of the activities of such agency, laboratory, or center to—

(A) prevent discrimination against women in science and technology;

(B) increase opportunities for the employment, training, and advancement of women in science;

(C) encourage the participation of minority women in scientific and technical careers; and

(D) encourage the participation of handicapped women in scientific and technical careers.

ANNUAL REPORT

Sec. 403. (a) The Director shall annually prepare a report concerning the participation and status of women in science and technology in Federal, State, and local governments, the private sector, and academic institutions. By January 30 of each year, the Director shall simultaneously transmit the report to the Congress, the Attorney General, the Director of the Office of Science and Technology Policy, the Chairman of the Equal Employment Opportunity Commission, the Director of the Office for Civil Rights of the Department of Health, Education, and Welfare, and the Director of the Office of Federal Contract Compliance Programs of the Department of Labor.

(b) The report required by subsection (a) shall contain an accounting and comparison, by sex and by discipline, of the participation of women and men in scientific and technological positions, and shall include—

(1) the number of individuals in permanent and temporary and in full-time and part-time scientific and technological positions by appropriate job category;

(2) the average salary of individuals in such scientific and technological positions;

(3) the number and type of promotional opportunities realized by individuals in such scientific and technological positions;

(4) the number of individuals serving as principal investigators in federally conducted or federally supported research and development; and

(5) the unemployment rate of individuals seeking scientific and technological positions;

(c) In preparing the report required by subsection (a), the Director shall use the report prepared by the Chairman of the Equal Employment Opportunity Commission pursuant to section 402 and may collect, compile, and analyze such other data and information as may be necessary.

Part B—Opportunity Programs

FEDERAL GOVERNMENT TRAINING FOR THE ENCOURAGEMENT OF WOMEN IN SCIENCE

Sec. 411. The Office of Personnel Management shall include in its training program for officials of appropriate Federal agencies, information and instructions relating to—

(1) the recruitment, retention, and promotion of qualified women scientists, engineers, and technicians;

(2) Federal laws and programs designed to assure equal opportunity for women in science and technology; and

(3) mechanisms to assure full participation of women in scientific and technological fields.

DEMONSTRATION PROJECTS

Sec. 412. The Foundation is authorized, after consultation with appropriate public agencies and private entities, to support, by way of grant or contract, activities of individuals, public agencies, and private entities designed to encourage the employment and advancement of women in science, engineering, and technology through—

(1) the establishment and implementation of cooperative research and education arrangements between business concerns and academic institutions;

(2) the development of work-study, preservice, or inservice programs leading to permanent employment or advancement;

(3) the development of programs to assist scientists and engineers to obtain new skills in order to chance fields, advance, or otherwise adopt to changing needs in science and technology;

(4) the development of programs to permit scientists and engineers to exchange positions or rotate between positions within and among public agencies and private entities;

(5) the establishment of new research opportunities for students, scientists, and engineers;

(6) the improvement of employment policies and conditions; and

(7) other appropriate activities.

VISITING PROFESSORSHIPS FOR WOMEN IN SCIENCE

Sec. 413. (a) The Foundation is authorized to make grants to academic institutions for the establishment of full-time or part-time visiting professorships for women in science. Such professorships may be held by individuals from the industrial, public, or academic sectors.

(b) An institution applying for a grant under this section shall assure that—

(1) each visiting professor will have appropriate research and teaching opportunities, as well as opportunities to serve as a source of advice and counsel for women considering careers in science and technology;

(2) the institution will establish or expand activities to increase the participation and advancement of women scientists and engineers in the activities of the institution, including research and instructional activities.

(c)(1) Each visiting professor shall serve in a department of an institution in which women are seriously underrepresented and in which the establishment of a visiting professorship is expected to increase the participation and advancement of women scientists and engineers in the research and institutional activities of the department.

(2) Each visiting professorship shall be for a period of at least one year and not more than two years.

TITLE V—GENERAL PROVISIONS COMMITTEE ON WOMEN IN SCIENCE

Sec. 501. (a) There is established within the Foundation a Committee on Women in Science, which shall be composed of 13 members. The Committee shall—

(1) provide advice to the Foundation concerning (A) the implementation of the provisions of this Act and (B) other policies and activities of the Foundation to encourage full participation of women in scientific, engineering, professional, and technical fields;

(2) establish goals for increasing the participation of women in science and technology;

(3) make recommendations to the Foundation concerning the manner in which funds appropriated to carry out the provisions of this Act should be distributed among the programs and activities authorized by this Act, taking into consideration the activities conducted and supported by other public agencies and private entities;

(4) provide advice to the Foundation concerning mechanisms to encourage women scientists and engineers to fully participate in all the programs of the Foundation, particularly research programs;

(5) provide advice concerning the appropriate manner to increase the number of women principal investigators on research projects, the development of flexible research support programs, and the improvement of cooperation between industry and academic institutions to facilitate research opportunities;

(6) make recommendations for the modification of the policies and procedures of the Foundation relating to the appointment of advisory committees and the selection of peer review committees in order to further the purposes of this Act;

(7) make recommendations for the awards established under part B of title III and for the selection of visiting women scientists under section 313; and

(8) evaluate the effectiveness of activities undertaken and supported under this Act.

(b)(1) Each member of the Committee shall be appointed by the Director with the concurrence of the National Science Board. The membership of the Committee shall represent a cross-section of the physical, life, behavioral, and social sciences. At least two members of the Committee shall be nonscientists. At least nine members of the Committee shall be women, of whom at least seven shall be doctoral scientists or engineers. In appointing members to the Committee, the Director shall consider recommendations submitted by governmental and private organizations active in promoting equal opportunity for women in science.

(2) The Chairperson of the National Science Board Committee on Minorities and Women shall be an ex officio member of the Committee.

(c) Members of the Committee shall be appointed to serve for a three year term, except that the terms of office of members first appointed shall expire, as designated by the Director at the time of appointment, five at the end of one year, four at the end of two years, and four at the end of three years. Any member appointed to fill a vacancy occurring prior to the expiration of the term for which the predecessor of the member was appointed shall be appointed for the remainder of such term. Members may be reappointed to serve one additional term for three years.

(d) Seven members of the Committee shall constitute a quorum, and any vacancy in the Committee shall not affect its power to function.

(e) Members of the Committee shall select a member to serve as Chairperson.

(f) Each member of the Committee who is not otherwise employed by the United States Government shall receive compensation at a rate equal to the daily rate prescribed for GS-18 under the General Schedule under section 5332 of title 5, United States Code, for each day, including traveltime, such member is engaged in the actual performance of duties as a member of the Committee. A member of the Committee who is an officer or employee of the United States Government shall serve without additional compensation. All members of the Committee shall be reimbursed for travel, subsistence and other necessary expenses incurred by them in the performance of their duties.

(g)(1) The Director shall establish in the Foundation a Special Assistant for Women in Science. The Special Assistant for Women in Science—

(A) shall be the principal adviser to the Director on matters relating ot the advancement of women in science and technology;

(B) shall provide such support, staff, and assistance to the Committee as may be necessary to carry out its responsibilities under this Act; and

(C) shall facilitate the implementation of recommendations of the Committee.

(2) The Director shall provide the Special Assistant with such support, staff, and assistance as may be necessary to carry out the duties specified in this subsection.

(h) The Committee, with the approval of the Director, is authorized to establish such additional procedures and criteria as necessary to implement the provisions of this part.

(i) Each year the Committee shall prepare and transmit to the Congress a report concerning its activities for the previous year and its proposed activities for the next year.

AUTHORITY

Sec. 502. (a) Except as otherwise provided in this Act the Foundation shall, in carrying out its functions under this Act, have the same powers and authority the Foundation has under the National Science Foundation Act of 1950 to carry out its functions under that Act.

(b) Except as otherwise provided in this Act, the Director shall, in carrying out the functions of the Director under this Act, have the same powers and authority the Director has under the National Science Foundation Act of 1950 to carry out the functions of the Director under that Act.

APPLICATIONS REQUIRED

Sec. 503. No grant may be made nor any contract entered into under this Act unless an application is submitted to the Director at such time and in such manner and containing or accompanied by such information as the Director may require.

SEVERABILITY

Sec. 504. If a provision of this Act is held invalid, the validity of the other provisions of the Act shall not be affected. If an application of a provision of this Act to a person or circumstance is held invalid, the validity of the application of the provisions to another person or circumstance shall not be affected.

AUTHORIZATION OF APPROPRIATIONS

Sec. 505. (a) In order to carry out the provisions of this Act, there are authorized to be appropriated $25,000,000 for the fiscal year ending September 30, 1981 and for each of the succeeding four fiscal years.

(b) Funds appropriated to carry out the provisions of this Act shall be allocated among programs and activities under this Act in accordance with the recommendations made by the Committee.

(c) Funds appropriated to carry out programs and activities authorized by this Act are in addition to funds appropriated pursuant to any other provision of law for the purpose of increasing the participation of women in science and technology.

Senator METZENBAUM. Our first witness today is Betty Vetter, executive director of the Scientific Manpower Commission.

I assume that all the witnesses have been advised that the usual procedure of the committee is to submit the entire statement of the witness in full and to ask the witness to make an oral statement that is normally substantially shorter than the full statement.

Ms. Vetter, we're happy to have you with us.

STATEMENT OF BETTY M. VETTER, EXECUTIVE DIRECTOR, SCIENTIFIC MANPOWER COMMISSION

Ms. VETTER. Thank you, Mr. Chairman.

Women are disadvantaged in the sciences almost from the beginning of their lives. Little girls are given different toys, exposed to different concepts, encouraged in different patterns of behavior than little boys. Although girls in elementary school are somewhat better than boys in arithmetic, by the time they reach the ninth grade, significant numbers have been persuaded that math is not for girls.

A study of data in the national longitudinal sample of the high school graduating class of 1972 found that only 21 percent of the women in that class compared to 36 percent of the men had taken six or more semesters of high school mathematics.

I think we can see the points of departure more easily if we look at a representative sample of a thousand boys and a thousand girls from that class. First we find that for every thousand boys that were born in 1954, 750 graduated from high school in 1972, as did 760 of the girls; 467 of the men and 406 of the women had entered college the following fall. Four years later, 83 of the men earned a degree in a quantitative field, namely, biology, physical or mathematical sciences, or engineering, but only 22 of the women graduated in these fields.

The following fall, 34 of the men entered graduate study in a quantitative field, as did 9 of the women.

If they follow the present patterns, in 1982, 11 of those men will earn a Ph. D. in a physical or math science, engineering or life science. Two of the women will earn a similar degree.

Among all students who completed a bachelor's degree in 1976, only 8 percent of the women, compared to 25 percent of the men, majored in a quantitative field. During the first 8 years of this decade, women have earned 46 percent of all the bachelor's degrees granted, but less than 15 percent of those in the physical, math, and engineering sciences, and only 32 percent of all those in all of the science fields, including the social and behavioral fields.

Over this decade women have earned 20 percent of all the Ph. D's awarded, but only 9.2 percent in the EMP fields, and only 14 percent in all of the science fields.

Even at the present rates of increase, it would be 40 to 50 years before we can approach equal proportions. So it is apparent the first problem occurs through the years of formal education.

The second problem comes when they seek jobs in science and engineering. Almost universally, women have higher unemployment rates than men in the same field, at the same degree level, and at the same age. Among doctorate men and women in 1977, the unemployment rates for women were two to five times higher than for men in every field of science.

Among recent graduates at lower degree levels, the unemployment rates for women are approximately twice that for men. Even among those who are employed, women are somewhat less likely than the men with whom they graduate and in the fields with whom they major to find a job in science or engineering.

Although women have doubled their proportionate share of earned doctorates in the sciences and engineering since 1970, their

share of academic employment shows little change. The proportion of women among scientists and engineers at colleges and universities has risen somewhat less than 1 percent from 1974 to 1978, from 15.1 percent to 16 percent. We don't know what proportion of these women are faculty members, what proportion are nonfaculty researchers or something else.

Within the doctoral population we can examine by field and Ph. D. cohort—and I will supply you in the statement with some of that information. It shows very clearly that women do not advance as fast as men in rank, and the variance between men and women grows broader with the older Ph. D. cohorts.

Neither industry nor Government employ women scientists and engineers in the proportion in which they are available. Except for beginning engineers, women earn less than men in every field, at every degree level, at every level of experience, and in every employment setting. The salary gap widens with age and experience and with higher degree levels.

Some of these salary differences can be explained by the fact that some women withdraw for a time to raise families. Most return to the labor force as soon as the youngest child is in school, if not sooner. But many need help to update their skills, obtain more formal education, or prepare to move into some new science area where demand exceeds supply.

More than a million women have earned bachelor's degrees in science and engineering since 1948, but the NSF estimates there were only 250,000 women scientists and engineers in this country in 1976. An additional 440,000 of these women were working, but working outside of science and engineering. Perhaps 300,000 of them were out of the labor force temporarily, for school or for other reasons.

Among these women are many who would like to find employment or opportunity for advanced training in science and engineering.

My prepared statement enlarges on these matters, and includes some of the pertinent data.

I would be happy to answer any questions you may have.

[The prepared statement of Betty M. Vetter follows:]

STATEMENT

BY

BETTY M. VETTER

before

THE SUBCOMMITTEE ON HEALTH AND SCIENTIFIC RESEARCH

COMMITTEE ON LABOR AND HUMAN RESOURCES

of the UNITED STATES SENATE

MARCH 3, 1980

ON S-568 - "WOMEN IN SCIENCE AND TECHNOLOGY ACT"

My name is Betty M. Vetter. I am the Executive Director of the Scientific Manpower Commission, a private nonprofit corporation formed in 1953 by a group of scientific societies to provide a focus for problems of manpower that are common across all the scientific disciplines.

In recent years, the Commission has had an increasing concern with opportunities for women and minorities in science. One of the actions resulting from that concern was the compilation of all of the available data on the participation of women and minorities in science and engineering, and in the total professional workforce, including data on their proportions of college enrollments, earned degrees, and utililization by field in all employment sectors.

I am the co-author with Eleanor Babco of the Scientific Manpower Commission of this data compilation, titled Professional Women and Minorities - A Manpower Data Resource Service, first published in 1975, which is kept up-to-date regularly. Most of the data I will report is in that book.

Science Education

Women are disadvantaged in the sciences almost from the beginning of their lives. "Girl's toys" differ from "boy's toys" which encourage exploration and spacial concepts. Many girls are encouraged to avoid necessary mathematics preparation by their mothers (who suggest that math homework questions wait until daddy is available), their elementary teachers who often see themselves as being devoid of mathematical ability, a "feminine" trait; and later by their high school counselors. A study of data in the National Longitudinal Sample of the high school graduating class of 1972 found that only 21% of the women in that class compared to 36.3% of the men took six or more semester hours of high school

mathematics. From this group, only 26% of the women, but 47% of the men who entered college entered a quantitative field - namely biology, physical or math science or engineering; and only 46% of that group remained in a quantitative field to the baccalaureate level. Among women entering college who took fewer than six semester hours of high school math, one in ten entered a quantitative field as a freshman but only 29% remained in these fields. Thus, for every 100 women in that high school graduating class only 21 took six or more semesters of high school math. If all 21 entered college, only five started a quantitative major and only 2.5 continued in a quantitative field to the bachelor's level. Among men, 36 of every hundred took six or more semesters of high school math. When these 36 entered college, 17 started in a quantitative field and 10 completed a bachelor's in these fields.

Even among women with high mathematical ability, only 50% took six or more semesters of high school math, compared to 65% of the men with high math ability. The study found that by the time this class reached high school, women faced a continuing disadvantage with men at four levels: (1) slightly lower basic math skills competency, (2) fewer math courses taken in high school for a given level of math competency, (3) a lower entry rate into quantitative fields for any given number of high school math courses, and (4) a lower rate of persistence in quantitative fields for the women who entered them.

Among all women who completed a bachelor's degree in 1976, only 3.2% majored in the physical sciences, mathematics, computer sciences, or engineering compared to 15.1% of the men. An additional 5% of the women and 10.2% of the men majored in the biosciences while 7.2% of the women and 9.9% of the men majored in the social sciences and 6.4% of the women and 4.5% of the men earned their degrees in psychology. Put another way, 8% of college graduate women in that class majored in quantitative fields compared to 25% of men. An additional 13.6% of women and 14.4% of men majored in a social or behavioral science.

Women are 51% of all high school graduates, but only 37% of those who have taken six or more semesters of mathematics during their high school years. During the period from 1970 to 1978, women have earned 46% of all the bachelor's degrees awarded, but only 14.7% of those in engineering, mathematics and physical sciences, and only 32% of all those in science and engineering including the social and behavioral sciences. Over this decade, women have earned 20% of all Ph.D.'s awarded, but only 9.2% of Ph.D.'s in engineering, mathematics and physical sciences and only 14.3% of all science and engineering Ph.D.'s. Although women are increasing their proportion in these quantitative fields at what appears to be a remarkable rate, they cannot reach the 50% level even at the present rate of increase for another 40 to 50 years.

Employment in Science

Opportunity for women to find employment in science and engineering, relative to the men with whom they graduate, has not equalized even at their present proportional representation among graduates. Almost universally, women have higher unemployment rates than men in the same field, at the same degree level and in the same age group.

Among doctorate men and women surveyed in 1977, the unemployment rates for women were two to five times higher than for men in each of the science fields, as they have been over the past three biennial surveys (Table 1).

Among the bachelor's graduates of 1976 surveyed in 1978, the unemployment rate for men was 3% and for women, 5.8%. The differences persist in almost every field (Table 1).

Even among those who are employed, women are somewhat less likely than men to find jobs in science and engineering. For example, among 1976 bachelor's graduates surveyed in 1978 by the National Science Foundation, women made up only 23.5% of the total from that class who were employed in science and engineering and 38% of the class who were employed outside science and engineering. As we have seen, they were 32% of the science and engineering graduates in that class.

Academic Employment

Although women are somewhat more likely than men to be employed at academic institutions, their share of academic employment shows little change. The proportion of women among scientists and engineers employed in colleges and universities has risen slightly less than 1% in four years, from 15.1% in 1975 to 16.0% in 1978. Unfortunately, we do not know the capacity in which these women are employed, the security of their jobs, or even whether they are faculty members, non-faculty researchers or are in some other position. A 1979 study by the National Academy of Sciences of non-faculty doctoral research staffs found that women were only 8% of faculty researchers while making up 20.7% of post-doctorates, 20.4% of non-faculty researchers and 23.7% of other academic staff.

We have information on doctoral scientists and engineers who were faculty members in 1977, by rank and Ph.D. cohort. (Table 2). While it is apparent that women who earned their Ph.D.'s in the 1950's and the 1960's hold academic rank well below men in the same fields from the same Ph.D. cohorts, we might have expected to find that those from the more recent classes would be advancing at rates comparable to men. However, even this is not true. Among the Ph.D. recipients of 1970-1974 who were employed in academic settings in 1977, considerably higher proportions of men than of women have reached the ranks of associate professor and professor while higher proportions of women are still lecturers or instructors.

In a recent book titled Fair Science, sociologist Jonathan Cole reports that among doctoral men and women in some science fields who earned their degrees in 1957 and 1958, the women were as likely as the men by 1975 to have found jobs in equally prestigious institutions. By 1970, however, Cole found the women holding significantly lower rank than the men 12 years after the Ph.D. Although he believes that this is principally because as a group the women had published less than the men, he also found that even the most prolific publishers among the women "were not nearly as likely to hold high ranking positions as their equally prolific male colleagues." Women in academe "still face formidable barriers to high rank."

Employment in Industry

It is not only in the academic world that women scientists and engineers are treated differently than men. They are seriously underrepresented in industry in comparison with their availability. Only 10.8% of all women doctoral scientists and engineers were employed in industry in 1977, compared to 27.2% of men. In part, this is because of the difference in field distribution among the sciences between the men and women, but this is not the whole difference. For example, only 23.3% of all employed women doctoral chemists were employed in industry compared to 53% of men. Less than 13% of doctoral women scientists were in management or administration, compared to 23% of men.

Employment in Government

In the government, women scientists and engineers are employed in somewhat closer approximation to their proportions within the available population, but they are generally employed an average one and a half civil service grades below men with the same credentials. Women are only 5.1% of scientists and engineers in the federal government, and in 1977, only 4.6% of employed women doctoral scientists and engineers were employed by the federal government, compared to 8% of men. Some of this difference can be accounted for by field distribution, and some by veteran's preference. Some remains. A number of studies of employment differences for men and women professionals at various federal agencies have shown that women in government advance more slowly than men with the same credentials.

Salaries

The fact that women advance more slowly in the academic ranks as well as in government and industry accounts for much of the salary gap that persists into the present, and has in some instances, widened (Table 3). But the gap begins with the first job after college. Except for new baccalaureate engineers, women earn less than men in every science field, at every degree level, at every level of experience and in every employment sector. The salary gap widens with age and experience, and with higher degree levels.

Since beginning salaries are determined in part by differing demand for graduates in different fields, it is no surprise that the petroleum engineers among last year's bachelor's level graduates got average salary offers that were more than $8,000 per year above offers to humanities graduates. However, this does not explain why women graduates in the biological sciences have beginning salary offers that are $1,200 less than those for men in the same class; in the health professions, salaries that are $3,000 less and in the social sciences $1,400 less (Table 4). Only in some of the engineering fields did women get slightly higher salary offers than men.

Among federally-employed scientists and engineers, women's salaries average 25% below men's, ranging from a differential of 18% in the life sciences to 33% among physical scientists. Differentials by degree level range from 32% among those with less than a bachelor's degree to 19% among Ph.D.'s. Even after regression analysis to account for differences in educational attainment, length of government service and age, an unexplained differential of 7% remains, ranging from 3% in the life sciences to 17% in the physical sciences.

Re-entry Programs

Some of the difference in salaries for experienced men and women can be explained by the fact that many women withdraw from the labor force for a time when their children are young. However, a recent study by the Scientific Manpower Commission found that at any point in time, about 85% of women graduates in science and engineering were in the labor force, despite the fact that half or more of mothers of pre-school age children had withdrawn temporarily. Most of them reenter the labor force as soon as their youngest child is in school, and those with higher degrees tend to be working at least part-time even during their children's pre-school years. (SCIENCE, Vol. 207, pp. 28-34).

Nonetheless, women who have been out of the labor force for periods of more than a year as well as those who are working outside of science and engineering because jobs were not available need opportunities to renew their skills, review and update their knowledge, obtain advanced degrees in some instances, and even to move into some new science area such as computer science where the demand exceeds the supply. Several features of this bill address that problem. There is the need for fellowships which do not require full-time study and which do not put ceilings on the age of the recipient. Retraining programs such as those which have been operated on a pilot basis by the National Science Foundation over the past few years are valuable. Perhaps most of all, women need to know where they can obtain information about reentry programs, opportunities for fellowships, and basic information about current and projected supply and demand in the various fields of science. The proposed Center for Women in Science would perform this function along with others.

Summary

Over the past few years, many efforts have been started to increase the proportion of women within the scientific and technological enterprise of the United States. Some effect already is noticeable. This has led to some feeling that reverse discrimination is occurring, and that programs geared to assist women to catch up in this professional workforce should now be stopped. No statistical data available support this contention in any way.

Other critics assert that the bill should be widened in scope to include minority men in the target population. The data available by race and sex concerning employment opportunities, salaries and grade levels indicate that minority men trained in science and engineering have moved quite close to majority men with the same credentials. Minority women, on the other hand, show the same problems of lower salaries and lower ranks than comparable men as do majority women.

The sex-aggregated minority data shows much wider discrepancy with white males in those areas with significant numbers of minority women (such as the biosciences) than in areas where few minority women are found (such as engineering). Inclusion of both sexes in combined data for "minorities" masks the significant differences between men and women scientists in employment and advancement characteristics.

This is not to imply that minority men in science and engineering have no problems. It is to say that these problems are different than those faced by women of all races in being able to participate in science and engineering on an equal basis, and that this bill should not be expanded to try to treat those problems as if they were the same.

TABLE 1

SOME UNEMPLOYMENT RATES FOR SCIENTISTS AND ENGINEERS, BY FIELD AND SEX

FIELD	PH.D.'S IN 1977		BACHELOR'S GRADUATES OF 1976, IN 1978	
	MEN	WOMEN	MEN	WOMEN
ALL S/E FIELDS	0.9	3.6	3.0	5.8
Mathematics	1.0	3.2	3.6	2.0
Computer Sciences	0.0	0.0	1.3	0.0
Physics/Astronomy	1.0	5.7	6.0	-
Chemistry	0.9	5.0	2.1	7.9
Environmental Sciences	0.9	4.8	6.6	7.3
Engineering	0.6	3.0	0.5	4.9
Agricultural Sciences	0.5	2.7	1.9	4.2
Medical Sciences	1.0	1.6		
Biological Sciences	1.3	3.9	3.8	7.2
Psychology	0.9	2.6	3.3	6.7
Social Sciences	1.0	4.0	4.6	5.5

Sources: National Academy of Sciences and National Science Foundation

SOURCE: Science, Engineering and Humanities Doctorates in the United States, 1977 Profile, National Research Council

TABLE 2

RANK FOR ACADEMICALLY EMPLOYED DOCTORAL SCIENTISTS AND ENGINEERS BY PH.D. COHORTS, ACADEMIC RANK, FIELD OF DOCTORATE, AND SEX, 1977

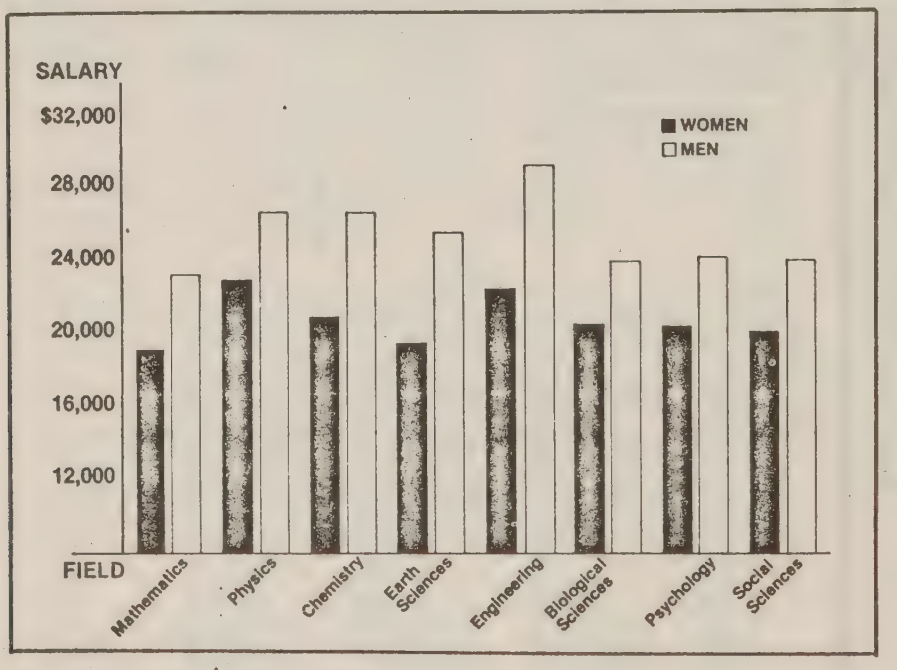
Ph.D. Cohort and Rank	All Fields		Field of Doctorate and Sex																					
			Mathematics		Comptr Sci		Phys/Astrn		Chemistry		Earth Sci		Engineering		Agric Sci		Medical Sci		Bio Sci		Psychology		Social Sci	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Total, 1934-1949 Ph.D.'s	3,566	731	656	60	–	–	823	28	1,682	73	225	7	532	1	452	–	155	19	2,113	285	533	106	1,395	152
Professor	82.6	56.5	92.1	66.7			65.9	60.7	79.4	53.4	83.6	100.0	83.8	100.0	85.2		89.0	0.0	82.4	42.1	93.1	72.6	85.7	73.7
Associate Professor	6.1	16.1	6.3	23.3			6.4	0.0	9.5	12.3	6.2	0.0	6.8	0.0	1.1		3.9	31.6	6.5	23.2	1.3	16.0	4.7	3.9
Assistant Professor	0.9	6.0	0.0	6.7			0.0	0.0	0.7	8.2	0.0	0.0	0.0	0.0	1.3		0.0	0.0	1.4	10.9	0.0	2.8	2.2	0.0
Instructor, Lecturer, Other	3.9	14.8	0.6	1.7			7.5	25.0	5.7	17.8	0.0	0.0	3.8	0.0	6.4		0.0	68.4	2.9	17.5	3.0	5.7	3.6	11.8
No Rank Reported	6.5	6.6	1.1	1.7			20.2	14.3	4.7	8.2	10.2	0.0	5.6	0.0	6.0		7.1	0.0	6.8	6.3	2.6	2.8	3.7	10.5
Total, 1950-1959 Ph.D.'s	25,704	1,828	1,615	63	17	–	2,761	59	2,925	240	850	21	2,517	4	1,595	16	570	56	5,604	643	2,649	348	4,601	378
Professor	81.9	53.5	86.7	69.8	100.0		73.5	61.0	73.5	52.9	87.3	52.4	87.4	25.0	81.6	87.5	77.9	73.2	78.7	45.4	83.5	54.6	90.2	58.7
Associate Professor	9.9	23.2	9.6	12.7	0.0		8.4	15.3	11.0	21.3	6.7	14.3	6.0	0.0	12.7	6.3	11.4	25.0	14.6	24.0	10.8	23.9	5.9	26.7
Assistant Professor	0.9	5.4	0.5	6.3	0.0		0.0	6.8	0.7	2.1	0.0	4.8	0.4	0.0	2.5	0.0	1.8	0.0	1.3	5.9	2.4	5.7	0.2	6.9
Instructor, Lecturer, Other	1.7	9.2	0.2	1.6	0.0		2.6	11.9	2.1	12.5	2.2	0.0	1.9	75.0	0.7	0.0	3.9	0.0	2.0	15.2	0.4	4.9	1.4	3.2
No Rank Reported	5.6	8.8	2.9	9.5	0.0		15.5	5.1	12.7	11.3	3.8	28.6	4.3	0.0	2.5	6.3	5.1	1.8	3.5	9.5	2.9	10.9	2.3	4.5
Total, 1960-1969 Ph.D.'s	53,159	5,167	4,617	322	161	11	5,472	111	5,311	526	1,725	31	7,870	31	2,849	41	1,370	138	9,905	1,740	4,562	1,128	9,317	1,088
Professor	42.8	21.6	42.1	29.5	49.7	36.4	34.6	7.2	35.5	13.7	50.3	12.9	48.4	35.5	49.0	41.5	42.6	29.7	35.8	15.9	39.7	20.4	53.1	33.0
Associate Professor	41.9	38.7	45.5	46.9	41.0	36.4	36.8	39.6	43.6	32.5	42.2	51.6	37.0	22.6	40.3	39.0	44.2	39.1	45.6	34.9	46.3	37.7	40.3	46.2
Assistant Professor	6.9	20.4	8.1	13.7	0.0	27.3	7.9	20.7	8.7	20.0	1.5	16.1	4.1	25.8	5.2	4.9	8.4	15.2	11.9	27.8	5.9	21.8	4.0	10.3
Instructor, Lecturer, Other	3.3	12.8	2.6	7.8	0.0	0.0	6.1	18.0	5.9	24.0	3.1	19.4	2.2	9.7	3.3	14.6	2.9	11.6	3.1	14.8	4.2	12.8	1.5	5.1
No Rank Reported	5.0	6.6	1.7	2.2	9.3	0.0	14.6	14.4	6.3	9.9	2.9	0.0	8.4	6.5	2.2	0.0	2.0	4.3	3.7	6.7	3.9	7.4	1.1	5.3
Total, 1970-1974 Ph.D.'s	40,062	6,921	3,278	316	419	27	3,419	135	3,126	410	1,366	68	3,798	42	1,979	82	1,286	260	7,910	2,127	3,894	1,474	9,587	1,980
Professor	4.4	2.0	5.6	1.9	1.2	0.0	1.8	0.0	2.5	1.7	1.4	5.9	6.0	0.0	5.4	0.0	4.1	8.5	2.9	1.1	1.6	1.1	7.6	3.1
Associate Professor	29.5	17.8	35.8	16.5	38.4	11.1	17.9	6.7	14.6	8.5	31.4	4.4	31.5	19.0	34.4	22.0	28.1	28.5	20.0	8.6	29.4	18.1	42.1	29.2
Assistant Professor	46.9	53.1	50.1	61.1	51.6	81.5	38.3	38.5	47.9	37.1	39.4	69.1	41.6	52.4	44.9	28.0	47.1	40.4	51.5	48.7	55.4	59.0	44.5	58.2
Instructor, Lecturer, Other	10.8	18.2	3.9	16.5	6.2	0.0	16.5	31.9	22.4	33.7	13.8	19.1	7.6	7.1	10.1	32.9	17.9	16.9	16.6	28.7	9.8	13.3	3.3	6.8
No Rank Reported	8.4	8.9	4.6	4.1	2.6	7.4	25.5	23.0	12.6	19.0	14.0	1.5	13.3	21.4	5.3	17.1	2.7	5.8	9.0	12.9	3.8	8.5	2.4	2.6
Total, 1975-1976 Ph.D.'s	11,456	2,704	900	109	132	25	918	43	907	139	443	57	1,255	16	478	36	357	146	2,328	698	1,214	590	2,524	845
Professor	0.5	1.0	1.3	1.8	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	6.8	0.0	0.0	1.5	0.8	0.8	1.2
Associate Professor	4.6	5.0	2.4	5.5	35.6	0.0	2.1	4.7	0.1	7.2	4.5	0.0	5.5	0.0	13.6	0.0	4.5	26.0	1.5	2.7	2.5	0.5	8.0	6.6
Assistant Professor	50.2	51.8	64.0	65.1	53.8	92.0	22.2	11.6	23.4	20.1	58.9	38.6	49.0	43.8	63.2	44.4	32.8	18.5	32.0	30.1	59.0	66.6	76.3	71.0
Instructor, Lecturer, Other	24.9	25.2	29.4	25.7	0.0	8.0	36.7	58.1	39.9	36.0	23.3	28.1	16.0	6.3	20.9	16.7	35.0	33.6	36.3	33.0	20.8	23.1	10.5	16.4
No Rank Reported	19.8	16.9	2.8	1.8	10.6	0.0	39.0	23.3	36.6	36.7	13.3	33.3	28.9	50.0	2.3	38.9	27.7	15.1	30.3	34.2	16.3	9.0	4.3	4.7

TABLE 3

DOLLAR AMOUNT OF MEN'S SALARIES OVER WOMEN'S SALARIES, DOCTORAL SCIENTISTS AND ENGINEERS, BY AGE, 1973 & 1977

1973 Salary Difference		1977 Salary Difference	
Under age 30	$1,580	Under age 30	$1,300
30-34	2,590	30-34	2,300
35-39	2,840	35-39	3,900
40-44	4,310	40-44	5,100
45-49	5,710	45-49	6,800
50-54	5,810	50-54	6,800
55-59	5,410	55-59	8,300
60-64	5,710	60-64	7,200
Over 64	5,240	Over 64	6,900
Overall gap	16.7%	Overall gap	20.5%

SALARIES OF DOCTORAL SCIENTISTS AND ENGINEERS, BY FIELD AND SEX, 1977



Source: National Academy of Sciences

SOURCE: The College Placement Council, A Study of 1978-79 Beginning Offers, Final Report, July 1979.

TABLE 4

AVERAGE STARTING MONTHLY SALARY OFFERS TO BACHELOR'S DEGREE CANDIDATES BY CURRICULUM AND SEX, 1977-78 AND 1978-79

CURRICULUM	No. Offers 1978-79 Total		Average $ Offers 1978-79 Total		No. Offers 1977-78 Total		Average $ Offers 1977-78 Total	
	Men	Women	Men	Women	Men	Women	Men	Women
BUSINESS								
Accounting	6,269	2,939	$1,205	$1,207	5,781	2,415	$1,124	$1,125
Business-General (inc. Management)	3,345	1,451	1,111	1,082	3,337	1,228	1,004	962
Marketing & Distribution	1,368	857	1,061	1,006	1,288	718	977	931
ENGINEERING								
Aeronautical	564	44	1,506	1,499	509	40	1,354	1,345
Chemical	4,849	1,461	1,640	1,648	4,225	1,068	1,512	1,517
Civil	3,823	601	1,397	1,435	3,057	472	1,280	1,335
Electrical[1]	10,006	736	1,518	1,546	8,068	531	1,366	1,381
Industrial	1,404	419	1,486	1,506	1,129	262	1,361	1,383
Mechanical	9,168	862	1,535	1,550	7,355	727	1,402	1,424
Metallurgical[2]	687	127	1,565	1,598	479	133	1,418	1,421
Mining	174	18	1,603	1,661	208	7	1,500	1,419
Nuclear (inc. Engrg. Physics	322	34	1,486	1,478	265	16	1,359	1,370
Petroleum	687	30	1,794	1,777	611	52	1,652	1,662
Technology	1,872	78	1,433	1,424	1,329	52	1,288	1,301
HUMANITIES & SOCIAL SCIENCES								
Humanities	258	400	1,023	957	392	618	925	837
Economics[3]	394	224	1,136	1,100	352	233	1,031	1,002
Other Social Science	620	709	1,039	914	609	814	961	843
SCIENCES								
Agricultural	464	93	1,064	957	555	102	978	896
Biological	140	104	1,048	975	172	141	1,095	964
Chemistry	236	143	1,340	1,319	229	111	1,199	1,176
Computer	1,488	780	1,411	1,381	1,394	409	1,269	1,256
Health (medical Professsions	95	375	1,357	1,104	52	412	1,045	937
Mathematics	414	342	1,340	1,304	346	333	1,192	1,177
Other Physical & Earth Sciences	266	52	1,380	1,304	251	64	1,243	1,223

[1] Includes Computer Engineering.

[2] Includes Metallurgy & Engineering Ceramics.

[3] Includes Economics programs with both business and Social Science Orientation.

Senator METZENBAUM. In your testimony, Ms. Vetter, you state that women are paid consistently less than men. From your data, can you determine if this discrepancy is due to the fact that women are actually offered less money for the same position, or is it because men are being offered the higher paying jobs?

Ms. VETTER. Both.

Senator METZENBAUM. Is it also possible that women are paid less, since the demand is less, in an effort to sell their services and their asking salaries are usually set considerably less than men?

Ms. VETTER. I think so. I think that explains the fact that when men and women are competing for the same job, the women often end up with the lower salary than the men. I think it's because most jobs start off with a salary range available, say from $10-12,000. If the woman is offered the $10,000, she usually will take it; while they may have to pay the $12,000 to the man. I think this explains much of the discrepancy in the beginning salaries.

Senator METZENBAUM. Your statistics are very persuasive. Can you speculate on the reasons why there are such differences both in training of women scientists and in employment?

Ms. VETTER. I think the cultural difference has principally kept women out of the sciences up until now. There have been brief periods in history—in the twenties, for example—when it was assumed that women were able to go into whatever they wanted to go into. Then came the thirties and the depression, the forties and World War II, and the fifties and the GI Bill for the men. The women went home again to raise families.

I think we are starting back again into the second wave of what began back in the twenties, opportunities for women to do and be whatever they want to, regardless of sex. But I think it has taken a long time and it still has a long way to go to overcome the cultural barriers.

Senator METZENBAUM. Have there ever been any studies made of attitudes of employers, or people generally, just people generally, regarding preferences in hiring men or women?

Ms. VETTER. There have been a number of studies and there are still a number going on. The answer is, by and large, the people who do the hiring are men and, by and large, men still prefer to hire men.

I think that part of the problem is that little boys are raised not to let a woman or girl do anything better than they do. That's one of the standard things one hears said to little boys: "You mean you let a girl beat you?" That makes it very difficult for a woman who gets to be in charge of men, it makes it very difficult for the men who must report to a woman. So it's just easier for everybody else around that the people who are employing continue to employ men in the responsible executive jobs.

Senator METZENBAUM. Do you think we can do anything about subjective perceptions by legislation?

Ms. VETTER. No.

Senator METZENBAUM. Do you feel this legislation would be meaningful or would it just be an effort on the part of Congress to react to a problem? We say we're concerned and want to do something about it, but do you think at the end of 5 or 10 years we would be much better off with the legislation and without it?

Ms. VETTER. Yes, sir; I think we would. I think it is important to note that most people don't do anything they don't have to do. Any time there are obligations put in by the law—or even opportunities put in by the law, to be taken advantage of—that will allow a change to take place over what has happened before, and then gradually, as women do move in to some of these positions, some men become convinced that, indeed, women can be scientists.

The more of this that happens, the better it is. And I think it's true in the way of salaries, too. Our society has always equated cost with value—that more dollars represent more importance. I think if women ever get treated equally in terms of salaries, they will also get more of the recognition. I don't think that will happen except with some law to push it.

Senator METZENBAUM. It is my impression that even if women have the same educational opportunities as men, the career development process still differs between the two groups.

What do you think is the time in the career developmental process that is most critical for women?

Ms. VETTER. I suppose the most critical point has to be back in the early years before they get out of high school. The women who fail to take the necessary mathematical requirements are very rarely going to come back in at some later stage and be able to pick this up.

But I think it's equally important—to recognize that the women who have gone through this procedure to become scientists have been filtered very highly—have gone through an awful lot of filters and have come through an awful lot of barriers—and it's high time for the younger ones coming up to be able to see that if they go through all of this, they will have an opportunity at the same kinds of jobs and the same kinds of salaries as men.

Senator METZENBAUM. I guess your point is "let the filtered woman rise to a total fulfillment", something like that?

Ms. VETTER. Yes, sir.

Senator METZENBAUM. Thank you very much.

Ms. VETTER. Thank you, sir.

Senator METZENBAUM. Our next witness is George Pimentel, Deputy Director of the National Science Foundation.

We're very happy to welcome you here today, sir.

Dr. PIMENTEL. Thank you.

STATEMENT OF DR. GEORGE PIMENTEL, DEPUTY DIRECTOR, NATIONAL SCIENCE FOUNDATION, ACCOMPANIED BY DR. JAMES RUTHERFORD, ASSISTANT DIRECTOR, SCIENCE EDUCATION

Dr. PIMENTEL. Mr. Chairman, I appreciate the opportunity to be here today. Dr. Atkinson very much regrets that a previous commitment prevents him from being here.

I have a prepared statement, and with your permission, I would like to submit my statement for the record and summarize my remarks.

Senator METZENBAUM. Without objection, so ordered.

Dr. PIMENTEL. NSF wholeheartedly supports the goals of S. 568, the Women in Science and Technology Equal Opportunity Act. We believe, as I think every member of your committee does, that it is

in the national interest and in the interest of fairness to promote the full use of all human resources in science and technology. An important part of this is that women have opportunity and encouragement for full participation in science and engineering careers.

With respect to the details of S. 568, there are some technical issues that deserve consideration. These technical issues, discussed in the testimony, concern such issues as salary, flexibility, and accountability.

Let me turn to what I believe is the real issue of the hearing today, as initiated by Ms. Vetter. There are some encouraging signs to take note of in choosing an optimum way to address this issue. One wants to look not only at the overall statistics of the labor force in which are embedded the last few decades of cultural disadvantage that women have suffered, but also at the more recent data which indicate what is happening today. Ms. Vetter already indicated, for example, that the proportion of women earning doctorates in science and engineering approximately doubled in the years from 1970 to 1977, including increases in every field. The number of women entering engineering with bachelor degrees over the period 1969 to 1978 grew tenfold. The tenfold growth is not based on a negligible number in 1969; it's a statistically significant growth and indicates that change can occur very rapidly.

I would like to say a few words about the trend of activities in the National Science Foundation with respect to this issue.

Early in the seventies in our ethnic minorities and women in science program we began to support research and experimental models directed at understanding the roadblocks that confront both minorities and women entering science careers. These studies indicated that some of the same mechanisms seem to channel minorities and women away from science.

Two principal types of projects were supported with respect to women in science: Studies to understand why women are underrepresented, and experimental projects to test ways to increase the movement of women into science careers.

In 1976 this led to the initiation of the women in science program, (WIS), that focused attention on three groups: college and university students, women with degrees in science who are not currently active in science, and high school students. The experimental programs of science career workshops and visiting women scientists have been well received and they give evidence of being effective. The science career workshops directed at undergraduate students and the science career facilitation project, these two activities will continue in 1981 with 30 science career workshops and 13 science career facilitation projects.

With reference to scope, let me quote these numbers. In fiscal year 1978 we attempted to reach some 5,100 participants. In 1979, it rose to 7,550; in 1980, it may reach 8,000; and in 1981, we expect to reach 11,000 girls and women in these two programs. The sum of these numbers is 31,700. Of course, many of those are undergraduate students. Some of those who took part in the science career facilitation project are women in the work force.

To try to place this in some sort of scale, the 1974 NSF statistics of scientists and engineers in the labor force indicate that there

were roughly 100,000 scientists and engineers who were women in the labor force.

Now, this number sounds in conflict with something that Miss Vetter said——

Ms. VETTER. NSF has changed its numbers since then.

Dr. PIMENTEL. I have the quotation from this table in the book that came out just last year.

In any event, whatever the numbers, this can be seen as a very significant activity in terms of the very large number of participants.

As another indication of NSF's interest the line item minority women and the physically handicapped has increased by 61 percent in 1981, the relative to the 1980 budget. The programs specifically targeted toward women in science are increasing 40 percent, from 1 million to 1.4 million.

As another indicator of our programs and the trends, which I emphasize are recent trends in 1968, of NSF's graduate fellowships 10 percent went to women. Ten years later, in 1978, 30 percent went to women.

In postdoctoral fellowships over a much shorter time scale, from 1975 to 1978, the women's percentage went from 11 percent to 30 percent. The affirmative action quality in that program is suggested by the fact that 30 percent of these postdoctoral fellowships went to women, though only 26 percent of the applicants were women.

Those statistics indicate, I think, the effectiveness and scope of some of our programs. They lead us to a significant conclusion relevant to some of the questions you asked Ms. Vetter.

We believe that the early adolescent years are an extremely crucial time, during which you can change attitudes. At the presecondary school level the social imprint is not yet established. At that level, one does have a very good chance of interesting both minorities and women in math and science, of giving them the feeling that this is just as much an activity in which they can excel as anyone else. We are placing a special emphasis there.

Along with that, it is crucial to place focused emphasis on preparation of the teacher. Teacher attitudes at that level are very important in the classroom, because, teachers can convey their own feelings of inadequacy and their own feelings of bias. The idea is to make sure the teacher is aware of the subtle ways in which those attitudes can be conveyed and is prepared to act in the opposite direction.

I agree that there is nothing more important at these early years than emphasis on mathematics. There is no question in my mind that entry into the quantitative fields of science and engineering depends very heavily on a feeling of comfort with mathematics, and I believe the cultural attitude toward women in mathematics has been one of the primary blocks of entry.

The fact that these attitudes can change rapidly is shown by this statistic: in Puerto Rico, some 68 percent of the students entering mathematics are women. Obviously, there may be different cultural settings, but this statistic nevertheless shows that one can change attitudes rapidly.

Let me just say a few more words about statistics. We mentioned that in bachelor's, degrees the number over the last 10 years has increased tenfold. At the Ph. D. level, the degrees awarded in 1955, 1965, and 1975, indicate the nature of the changes that we are seeing. In 1955—new chemistry Ph. D. degrees in chemistry—hey represented 5 percent women. In 1965, this had changed only to 6 percent.

In 1975, that number had doubled. That shows it is a very considerable acceleration and it indicates that attention to this problem is bearing some fruit.

I would like to give one more statistic—on starting salaries. Again, I am quoting statistics in chemistry because the statistics are relatively firm there, and statistically significant in terms of the number responding.

For bachelor's degrees in 1977, median starting salaries in industry for men were $12,500; for women, $12,600. In colleges and universities, the median salary was $8,300 for men, $8,400 for women. For all employers—high schools, Federal Government, hospitals and so on—the numbers came out to $12,000 for both men and women.

For master's degree holders in industry, the statistics are consistent with the negative indications that Dr. Vetter quoted. For men in 1977, the starting salary was $15,500; for women, $14,500—and I don't know why those numbers differ from bachelor's degrees and Ph. D.'s. For chemistry Ph. D.'s in industry, the 1977 starting salary for men was $20,000, for women, $20,165. Not a significant difference, but perhaps significant because it is on the positive side rather than on the negative side.

I think this indicates that society does want change, and it's possible to change salary discrepancies.

In closing, let me say again that—we are already undertaking many of the activities authorized in S. 568. Equally important, in my view, is the special attention being paid to women and minorities in all of our programs in science education. We list a number of these programs in my testimony. In every one of these programs we are trying to direct specific attention to addressing the special needs of minorities and women.

The NSF takes great pride in the contributions these programs have already made, and we reiterate our strong commitment to the goals underlying S. 568.

[The prepared statement of Dr. Pimentel follows:]

STATEMENT BY DR. GEORGE PIMENTEL
DEPUTY DIRECTOR, NATIONAL SCIENCE FOUNDATION
BEFORE THE
SUBCOMMITTEE ON HEALTH AND SCIENTIFIC RESEARCH
COMMITTEE ON LABOR AND HUMAN RESOURCES

UNITED STATES SENATE

March 3, 1980

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

Thank you for the opportunity to comment on behalf of the National Science Foundation on the revised Women in Science and Technology Equal Opportunity Act, S. 568. The Foundation strongly believes that the vitality of the Nation's scientific and technological efforts can be enhanced by the full involvement of all individuals possessing interest and talent in science and engineering. The underrepresentation of women in most aspects of the Nation's science and technology enterprise must be changed -- it is not fair and it represents the loss of a significant national resource. With the increasing importance of science and technology in our society, we can no longer afford to bypass this important talent pool.

There is some evidence that the situation is improving, undoubtedly aided by shifts in the attitudes of the society in general as well as by programs designed to address the underrepresentation of women in science and technology. Enrollments, for example, of women in science and mathematics courses are increasing. These signs encourage NSF, as they should encourage other institutions, that our efforts in this direction are effective and should be continued.

It is useful to discuss S. 568 in the light of NSF's recent and on-going activities to increase the participation of women in science. After early efforts in

60-781 O - 80 - 3

the 1960's supporting special institutes for mature women seeking to reenter science, in fiscal year 1970 the Foundation authorized institutions receiving NSF Graduate Traineeship grants to offer part-time traineeships to enable married women with responsibilities in the home to pursue graduate education on a part-time basis. This provision is still in effect, and we recently extended the concept to the Post-doctoral Fellowship Program.

In fiscal years 1974 and 1975, NSF's Directorate for Science Education invited the submission of two kinds of proposals. The first was for studies to provide an understanding of the reasons for the underrepresentation of women in science, and the second for experimental projects to develop and test ways to increase the number of women moving into careers in science. During 1974 and 1975 the Foundation supported 16 such studies and 12 experimental projects. These provided useful guidance in our development of later programs.

In fiscal year 1976, the Women in Science (WIS) program was formally established. The Women in Science program initially directed its efforts to three groups: college and university students, women with degrees in science who are not active in science, and high school students. The mechanisms used were one- or two-day Science Career Workshops, Science Career Facilitation Projects, and a Visiting Women Scientists Program for high schools. The WIS program was deliberately made experimental, so that the program could be modified with increasing experience and evaluative feedback. Over the first four years of the WIS program, the Foundation supported a total of 99 one- or two-day, multidisciplinary Science Career Workshops for women college and university students, or alumnae with at least a Bachelor's degree in science who were neither in graduate school nor in scientific jobs commensurate with their training. The purpose of these workshops, carried out by grantee colleges and universities, is to provide the participants with information and practical advice regarding science careers.

A second experimental sub-program, Science Career Facilitation Projects, has funded projects aimed at women with science degrees who have been away from science for at least two years. The objective is to update and amplify the original scientific training of the participants to the point where they can enter graduate programs or obtain immediate employment in science. The projects have been largely in fields characterized by greater than usual underrepresentation of women and by good opportunities for employment. Analysis of the program's impact indicates that even a relatively short program can significantly update the skills of women who have been away from science for a considerable time period.

The Visiting Women Scientists Project was a pilot program carried out during academic years 1977-78 and 1978-79. During the two years, 90 women scientists and engineers visited approximately 250 high schools throughout the Nation, serving as role models to some 40,000 students, and providing career information to teachers and counselors as well as to the students. Evaluation results were quite positive, indicating a high degree of interest on the part of high schools in having such visits, willingness on the part of the women scientists to make additional visits, and the encouragement of female students to seek further information about science careers. This experience, including the development of materials and compilation of a roster of visiting women scientists, now serves as a model for other interested organizations and groups.

In addition to the specially targeted efforts of the WIS program, the Science Education Directorate is now making special efforts to encourage and facilitate the participation of women in science in all of its programs. Two of Science Education's current priorities -- the focus on early adolescence and the focus on improving the status of underrepresented groups in science -- will increase the

proportion of directorate funds going to women scientists or affecting future women scientists. The appended table briefly indicates the type of activities in some of our regular programs that can potentially affect women.

The present version of S. 568 is the result of an extended and valuable exchange between the bill's authors and sponsors and a variety of interested individuals and institutions. We believe that this effort to obtain a wide range of responses has resulted in a stronger bill with potential for increasing the participation of women in science and technology.

We are clearly in support of many of the findings, purposes, and policies set forth in S. 568. Further, many of the objectives contained in Title II of the bill are consistent with those of ongoing science education programs in NSF and the new Department of Education. In this regard, we believe that existing legislation provides adequate authority for both agencies to meet these objectives and that additional legislation is unnecessary.

We still have serious reservations about the provisions in Titles III and IV of the proposed bill, as well as the authorization for the appropriation of additional funds. Many of these activities we believe to be inconsistent with Administration policies.

We feel that there remain a few structural problems still posed by S. 568 in Title V. I would like to take a few moments to describe these points. The present version of S. 568 greatly expands the role and responsibilities of the Committee for Women in Science. As presently provided for in S. 568, this new Committee would present some conceptual problems relating to optimal roles for an advisory committee. The NSF agrees that the concept of an advisory committee for women in science may be a desirable one. However, a few of the specific responsibilities assigned to

this committee by S. 568 may be inappropriate:

---The bill specifies that the Committee determine the allocation of appropriated funds to programs and activities authorized by S. 568. While the NSF would solicit and welcome Committee advice and recommendations on allocation of funds, it is recommended that the bill allow the Director to allocate any such funds. This is required in all other NSF programs by NSF policy and procedures, which are designed to fulfill and guarantee NSF accountability for the disbursal of public funds appropriated to its programs.

---The bill specifies that the Committee will evaluate the effectiveness of activities undertaken in response to S. 568. While the Committee will undoubtedly need to utilize the results of such evaluations, it would require a substantial staff and expertise not likely to be present on the Committee, and furthermore, would duplicate ongoing staff effort of the NSF.

--- The bill specifies the Committee will be paid at the GS-18 rate of compensation. While for some federal agencies the GS-18 rate is the norm, the NSF has a long-established tradition of drawing on the expertise of the field and reimbursing with a more nominal amount. To avoid internal and discriminatory differentials in compensation rates among advisory committees, the compensation of any Committee for Women in Science should be in accordance with existing NSF policy.

Secondly, we are concerned that the bill calls for naming not only a special assistant but also a staff for this assistant within current staff allocations. We would recommend that the Director be allowed to determine the type of staff needed as well as the organizational assignment of such staff, so that the responsibilities of the Director can best be met.

I would like to note, in closing, that NSF is now undertaking many of the activities authorized in S. 568 for women in science. Equally important, in my view, is the special attention being paid to women (and minorities) in all programs in science education. The NSF takes pride in the contributions its programs have already made and we reiterate our continued strong commitment to the goals underlying S. 568.

This concludes my statement, Mr. Chairman. I would be glad to answer any questions you may have.

TABLE I
NON-TARGETED
SCIENCE EDUCATION PROGRAMS
RELEVANT TO WOMEN

PROGRAM	ACTIVITIES
Research in Science Education	Investigations of the barriers to women in science study and/or occupations.
Development in Science Education	Development of new materials and approaches relevant to women students/ scientists.
Comprehensive Assistance to Undergraduate Science Education	Broad support to colleges and universities to improve the visibility and quality of science programs.
Local Course Improvement	Course improvement in science, including non sex-biased content and materials.
Information Dissemination in Science Education	Facilitating broader awareness of materials especially relevant for women.
Undergraduate Research Participation	Opportunities for female students to become involved in the research process.
Student Science Training (high school)	Same as above
PreCollege Teacher Development	Sensitizing high school teachers to the needs of women students.
Science Faculty Professional Development	Sensitizing college faculty to the needs of women students.

Senator METZENBAUM. I think our first two witnesses have very clearly spelled out the issues. I think, Dr. Pimentel, you point out, maybe from a male perspective, how far women have come. Ms. Vetter also points out how far they have come but how much further they still have to go.

Dr. PIMENTEL. Yes, sir.

Senator METZENBAUM. And in that connection——

Dr. PIMENTEL. I agree with the last part, but not the "male perspective." [Laughter.] I have three daughters.

Senator METZENBAUM. Let me come to the issue before the committee.

Are you in favor of the legislation or opposed to it?

Dr. PIMENTEL. I am in favor of the goals of the legislation. I do believe that we have authority to conduct a very significant fraction of the proposed programs and, in fact, are conducting many of them—not all of them by any means. Consequently, I feel that insofar as we have those programs in place, the legislation may not be necessary.

There are one or two aspects of the program which I believe would be difficult to rationalize with the administration's policies. For instance, the addition of the $25 million, would be in contrast to the administration's attempt to observe some fiscal restraint.

Senator METZENBAUM. How much of an increase is the National Science Foundation asking in this year's budget?

Dr. PIMENTEL. The total increase is some 15 percent.

Senator METZENBAUM. On the total number?

Dr. PIMENTEL. Yes, sir.

Senator METZENBAUM. And what are those total numbers?

Dr. PIMENTEL. Eleven forty-eight is the total amount requested, and——

Senator METZENBAUM. Eleven forty-eight? That's $1.148 billion?

Dr. PIMENTEL. Yes, sir.

Senator METZENBAUM. And that is about 15 percent more than your budget for last year?

Dr. PIMENTEL. Yes, sir.

Senator METZENBAUM. That obviously exceeds the inflation rate and obviously exceeds the rate of increase of health requests and many other requests in the budget?

Dr. PIMENTEL. That's correct. The President has made a specific commitment to the continued support, even in difficult budgetary times, of fundamental research as an activity in the long-range interest of the country, and I believe in this policy.

Senator METZENBAUM. He has also made a commitment, as I understand it, to the Equal Rights Amendment and is concerned about women's rights. Out of that $1.148 billion request, if you find $25 million, do you think that will be a deterrant or any special problem either for you, OMB, the President, or the Congress?

Dr. PIMENTEL. May I respond by observing the activities specifically targeted toward women, in a budget that is going up 15 percent, were increased 40 percent. I think that indicates our desire to place emphasis in that direction.

Senator METZENBAUM. That's like the Chinese who told me, when I visited them, how their rate of growth had been 19 percent a year over the last 10 or 12 years in industrial output. Then I

asked them for their base figure and found it was difficult to get that.

This 40 percent increase may not be that significant, depending upon what your base is. If the base was so low to begin with, it doesn't really mean that much.

Dr. PIMENTEL. Senator, I would agree if that were all the Foundation is doing. I want to remark again that we feel the emphasis on the junior high school level, the preadolescent level, is a program of very great importance to increasing the access of women in science. I have indicated also that in all of our science education programs we have made a conscious effort to move toward the entry of women and minorities into science. Presently, those programs devote approximately 18 percent of their funds in the direction of increasing the access of women to science. So pulling out that one number very much underestimates the total activity of the National Science Foundation in this arena.

Senator METZENBAUM. I understand the increase for women is from $1 million to $1.4 million.

Dr. PIMENTEL. That's in the specific line item for women. When I quoted the number 18 percent, that, of course, refers to the sum of a large number of programs. In fact, the list is appended to my testimony.

Senator METZENBAUM. Dr. Pimentel, last year at the fiscal 1980 NSF appropriation hearings, NSF stated that it was requesting a $500,000 reduction in the minority, women, and handicapped science program. The reason given—and I quote—"In that program, which was experimental, we felt that we had learned enough there so that we could move some of those funds elsewhere."

Now, this year you're asking for $400,000 more, an increase for women in science programs. What has changed?

Dr. PIMENTEL. May I ask Dr. Rutherford, who is the Assistant Director for Science Education, to address that question?

Dr. RUTHERFORD. Last year, you know, we really felt that the fundamental issue here is to get some 20-odd programs that serve our schools, our colleges, at all levels doing different tasks, to address the problem of access of minorities and women. It would never be sufficient to have labeled programs because we simply could never get sufficient money, and besides, it duplicates what we're already doing.

Therefore, we made a strong effort to move in one program after another more and more activities, where we use our regular program funds to address this issue.

I felt that we were making enough headway in doing that that we were in a position where we could reduce, in a tight budget, the women in science funds. Because as we track this, we are, in fact, dramatically increasing the investment we're making in this program, this problem.

Now, Congress last year saw it differently. Congress view of the situation was that we shouldn't have reduced those programs. We reached these matters by consensus and it seemed to me that as a matter of adjustment this year we would try to do both; that is to say, listen to Congress, as we do from time to time, not always, and get that message, deal with it, and in the meantime continue to strengthen our other programs.

Dr. PIMENTEL. The reduction was explicitly connected with our desire to place more emphasis on the needs of minorities and women through the much larger investment of our regular programs. We have increased the percentage of the funds in these regular programs for that purpose.

Dr. RUTHERFORD. If I could add one other thing about the funds and the question of the $25 million, it is the nature of the budgeting in the Foundation that the science education budget and research budgets are essentially two different things. They go by different sets of rules and are determined in quite a different process.

Almost all of the things in the bill before you would, in fact, be located in the science education budget. So the question is $25 million as a fraction of $85 million, which is the science education budget. Suddenly it looks to be quite a different percentage than when you're addressing it to the research budgets which are determined separately.

Senator METZENBAUM. Let me just ask a final question, which is the same question I asked before.

You have indicated you support the general concept of the bill, but I gather you have difficulty with the $25 million appropriation. Having said that, does the Foundation support the legislative approach to this problem as spelled out in this bill?

Dr. PIMENTEL. I can only reiterate the reply I made, and I'll not make reference to the appropriation aspect of it. The National Science Foundation is engaged in many of the activities that are specifically called out—not all—but the ones in which we are engaged we believe are very responsive to the needs. We do not believe that additional legislation is needed for those purposes.

There are one or two provisions in the bill that are not activities that we now carry on because we believe there are other, more effective approaches. Consequently, we would again say the legislation is not necessarily needed.

We believe in the goals of S. 568 very strongly.

Senator METZENBAUM. But you do not support the legislation?

Dr. PIMENTEL. That is correct, sir.

Senator METZENBAUM. Thank you very much.

Now, Miss Vetter, Dr. Pimentel has made some statements that are somewhat at variance with the thrust of your remarks.

Very briefly, I think it's only fair that I give you an opportunity to respond or to comment in connection with anything Dr. Pimentel has stated, that you feel you would like to rebut.

Ms. VETTER. Only in one instance, in the data. I know where he found his $1 million figure. Apparently you don't know that NSF has revised all those figures, and I——

Dr. PIMENTEL. I would not have quoted them if I knew they were revised.

Ms. VETTER. I have both the old ones and the new ones with me.

Dr. PIMENTEL. It was a specific reference to the number of women in the work force.

Ms. VETTER. Yes. I think this is one of the things the bill does not address—well, it does, but very indirectly.

Senator METZENBAUM. Well, you know it, and the doctor knows it, but would you share the information with us so we may know, what and in what way was it revised?

Ms. VETTER. Upward. NSF had never done anything much about looking at what proportion of the scientific work force was made up of women or minorities until about 1974, at which time they started some data processing in that field and came up with a very astonishing finding, that of all the women who had been trained in science and engineering and who were counted in their data as being scientists and engineers, 53 percent were in the labor force and 47 percent were out of the labor force. This was such an astonishing finding to those of us who were more familiar with the data in regard to working women who had graduated in any field, and this meant that women who had graduated in science were much less likely to be working than women who had graduated in anything else.

This seemed not right to us and we asked them for a grant to help figure out whether this was true or not. They did give us the grant and, indeed, in the meantime, they started back looking through their own figures and found out that they were wrong, that the real labor force participation was 85 percent.

They revised the figures and have published them, but I'm not surprised that you haven't seen them because, although the others were published widely, these appear only in the second appendix of the detailed statistical tables of the report on scientists and engineers in 1976. So it was not widely publicized. But that has been changed and it did change the numbers.

One of the problems at NSF is—one of the data problems—is that the data in the 1970's has been based principally, of course, on what was started in 1970 itself, both with the census and the post-censal survey—and some data problems were inevitable. In 1970 not very many people cared how many women were working. So the data has been in some ways flawed throughout the decade because of that.

It is the hope of many of us that as we begin the 1980's, with the opportunity for new data bases, and for taking advantage of the fact that if you do a little better sampling for the thing you're trying to find out, you can find out more about it, that this will change in the eighties and we will be able to keep track much better.

Dr. PIMENTEL. Am I correct, however, that this is an intrinsic and very difficult problem in determining the total work force? You do not feel the other numbers I quoted are flawed, do you?

Ms. VETTER. No, sir, I think we agreed on the others.

Dr. PIMENTEL. Yes, I do, too.

Ms. VETTER. Your salaries for chemists are, of course, the ACS ones. There are about five sets of salary data for beginning salaries. The ACS ones apply only to members of the American Chemical Society. The ones collected by the College Placement Council and the Endicott survey and such continue to show, I'm sorry to say, that women are slightly below men in just about the same proportion that the ACS ones showed the beginning baccalaureate salaries to be slightly above.

But if we add beginning chemists to the one other field that shows women picking up just a little more beginning salary, which is women engineers, we see that we have something really unique because there aren't any other fields where that's true.

I might add that the difference is 50 cents a day for women engineers. It's $180 a year, and that's 50 cents a day. But it certainly makes a difference because it's the first time ever that women got average starting salaries that were higher than men's.

Senator METZENBAUM. Thank you very much, Miss Vetter. And thank you very much, Dr. Pimentel. We were happy to have you with us today.

We now have a panel of four witnesses. Ann Reynolds, Shirley Malcom, Margaret Dunkle, and Mary Kostalos.

I am particularly pleased that Dr. Ann Reynolds is a part of the panel, and I am proud of the fact that she appears here today as provost of the university from which I myself graduated, Ohio State University. She is appearing on behalf of the Association of American Universities, the American Association of State Colleges and Universities, the Association of Catholic Colleges and Universities, Association of Graduate Schools, Council of Graduate Schools in the United States, the American Council on Education, the National Association of State Universities and Land Grant Colleges, and the National Association of Independent Colleges and Universities. It seems your constituency, Dr. Reynolds, is larger than mine.

Shirley Malcom is director of the Office of Opportunities in Science, American Association for the Advancement of Science.

Margaret Dunkle is president of the Federation of Organizations for Professional Women, and Mary Kostalos is codirector of women in science career facilitation program, at Chatham College.

We are happy to have all of you.

Dr. Reynolds, would you please proceed first.

STATEMENT OF DR. ANN REYNOLDS, PROVOST, OHIO STATE UNIVERSITY; DR. SHIRLEY MAHALEY MALCOM, DIRECTOR, OFFICE OF OPPORTUNITIES IN SCIENCE OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE; MS. MARGARET DUNKLE, PRESIDENT, FEDERATION OF ORGANIZATIONS FOR PROFESSIONAL WOMEN; AND DR. MARY KOSTALOS, CO-DIRECTOR, WOMEN IN SCIENCE CAREER FACILITATION PROGRAM, CHATHAM COLLEGE, A PANEL

Dr. REYNOLDS. Thank you, Senator.

Mr. Chairman and members of the subcommittee, my name is Winnetta Ann King-Reynolds. I became the provost of the Ohio State University 6 months ago, and I am also professor of anatomy, obstetrics, and gynecology. I am a developmental biologist working in the fetal period and have recently studied islet cell transplantation in monkeys to alleviate diabetes, calcium metabolism, and organic mercury toxicity in the developing primate and humans, among many other research interests.

My testimony represents the views of a number of educational organizations which Senator Metzenbaum has already listed. My statement has been submitted to you previously and with your

permission, Senator, I should like to summarize it and make some personal comments.

Senator METZENBAUM. Your statement will be included in full in the record.

Dr. REYNOLDS. Thank you.

I support many of the objectives of this bill, for many reasons. First of all, it emphasizes encouraging young women in elementary and high school to become aware of scientific opportunities, and that is where career decisions are made, consciously or subconsciously.

We see far too many talented and intelligent women enter the Ohio State University who have never seriously considered the sciences as an option and whose limited mathematics backgrounds would make a science major difficult, or overly prolonged at best.

In comparison to the 1960's, and to the dismal levels of the 1950's. The 1970's have brought us increasing enrollments of women graduate students in sciences. However, the timing is ironically poor for young women scientists, especially in the academic job market. Our institutions of higher learning in the United States are severely limiting tenure track openings, and this condition will worsen as enrollments level off and drop.

Some of our science department at our institution are approaching 95 percent tenure density. Thus, when we finally do have increased graduate school enrollments of women to a modest extent, their job opportunities will be limited and highly competitive. Therefore, I urge that you consider as an addition to the bill a program of national research awards for young women scientists targeted for the initial years of young women's careers who have outstanding potential for research in a university setting. These awards would be administered competitively by the National Science Foundation. They would serve to set up a research laboratory, a prospect that is increasingly difficult in these inflationary times, and as university resources have grown skimpier.

This is a critical time for the young woman scientist and modest support at this juncture could insure a lifetime of productive research for her.

I wish to also bring up a note of personal gratitude. There is an old song, a woman's lament, from an entirely different set of feminine circumstances, that contains the phrase "you made me what I am today." The Congress of the United States in the 1950's did just that for me, by authorizing the NSF predoctoral fellowship awards. I received one in 1958 as a very unexpected surprise. I was attending a small teachers college in Kansas at the time. That fellowship supported me completely through my doctorate in zoology at the University of Iowa. In fact, several graduate schools competed for my selection because of that award, and I ended up in an excellent program.

Upon completing the doctorate in 1962, I immediately received my first NIH research award and have had uninterrupted support since. I am still a coinvestigator on three projects.

The congressional support of the National Science Foundation and of Health, Education, and Welfare results in graduate school training of meritorious women and minorities and encourages their subsequent success in the research field.

As a woman, I have been beset by other influencing forces. Societal pressures and the birth of children tend to add to one's load and make a scientific career overwhelming at times. The trust placed in me by the NSF and NIH support given to me has always been a positive encouragement as well as an obligation. It has made me feel I could never give up, no matter how conflicting were the ofttimes justifiable other demands on my time. It has brought me here today when I am sure my president would prefer I were attending to our deans. It has made me take on unpleasant and thankless jobs that needed to be done for universities, for government, and other institutions committed to the public welfare.

But the pool of women who choose science courses and careers is still too small. There are still too few women scientists. We must concentrate now on childhood and adolescent experiences where career choices are made, and on career opportunities for young women scientists.

Thank you.

[The prepared statement of Dr. Reynolds follows:]

TESTIMONY

BEFORE THE

SENATE SUBCOMMITTEE ON HEALTH AND SCIENTIFIC RESEARCH

On the Bill

S.568, The Women in Science and Technology Equal Opportunity Act

By

Dr. Ann Reynolds

Provost, Ohio State University

on behalf of

American Association of State Colleges and Universities

Association of American Universities

Association of Catholic Colleges and Universities

Association of Graduate Schools

Council of Graduate Schools in the United States

American Council on Education

National Association of State Universities and Land Grant Colleges

National Association of Independent Colleges and Universities

March 3, 1980

Mr. Chairman and members of the Subcommittee:

I am Dr. Ann Reynolds, a developmental biologist, a professor of anatomy, obstetrics and gynecology and Provost of Ohio State University. It is a pleasure for me to present to you today the views of several of the nation's major higher education associations on the bill S.568, The Women in Science and Technology Equal Opportunity Act.

The members of the eight associations which I today represent together train and educate almost all of the nation's most highly skilled scientific and technical personnel. They confer virtually all of our advanced degrees and perform most of the federally-supported basic research programs conducted in the country. It is in these institutions that the most able young women scientists receive their advanced education and training and where they seek to pursue careers as academic research scholars and teachers. The nation's research universities and graduate level colleges represented here play a key role both in identifying and educating the most able young women, and in providing places for them to pursue productive careers as investigators and instructors. It is also in these institutions that the ultimate objectives of the "Women in Science" bill will either be met or fail.

As a scientist, as a woman and as a university administrator I would like to express to you our commendation and support for the general objectives addressed by the bill. S.568 seeks to address a set of complex and important problems confronting the nation and our educational institutions. Solutions to these difficult and complex issues remain elusive. The bill attempts to address them by setting forth a number of activities which together would serve to inform, encourage and provide incentives for young girls and women to pursue careers in science and engineering. It rightly emphasizes the importance of identifying and recognizing talented elementary and secondary age children and

encouraging them early to consider and prepare for scientific careers. It is here that our educational system seems to be failing and it is at that level of our educational system that the greatest challenges and needs appear. We commend the bill for its attempt to address the elementary and secondary educational needs of female students.

If we are to address successfully the array of social, economic and technological problems that confront us as a nation, we must effectively utilize all of our very best minds. The comprehensive approach proposed by the diverse elementary, secondary, higher and continuing education programs offered in the bill provides a good starting point and an overall strategy which, if thoughtfully implemented, could begin to address effectively the complexities we face in this area. I will, however, limit my remarks this morning to that area of the educational spectrum with which I am most familiar and qualified to speak -- the research intensive university.

As the Committee considers the initiatives proposed by S.568, we would urge you to bear in mind that part of the problem which is shaped by the present university environment. Young scientists, male and female alike, first enter as graduate students and later as young researchers in institutions now beset by a complex array of difficult problems. These impinge, often adversely, on career chances of both young men and women researchers.

First, after allowing for the wide variation among universities and departments, many still face a prolonged shortage of tenure line career openings for new faculty. Staffing patterns and needs vary widely among these institutions, but it is generally true that in many fields few tenure career openings are now available for the next generation of young investigators, male or female. As a result, the competition for the relatively few spaces available is intense. Highly qualified scientists who would have been appointed just a few years ago are now effectively shut out of an academic career in first-rank institutions. Fewer still achieve full tenured status.

Those fortunate ones who are appointed to our faculties face an intensely competitive environment characterized by demands to conduct increasingly sophisticated and costly research with inadequate tools and hampered by steadily eroding research support. Despite recent and welcome budgetary increases for the research programs of the National Science Foundation and other agencies, support for most investigators remains difficult to obtain, and then often inadequate to mount a fully-developed, well-paced, sustained program of research. As a result, the pressure continues to mount on beginning and established faculty to compete ever-intensively for scarce resources. Faculty are increasingly burdened by administrative and regulatory requirements and by a shortage of resources to acquire needed instrumentation, support equipment and personnel.

As federal support for the competitive project system has steadily tightened, faculty members have watched inflation steadily erode the purchasing power of their research awards. There are broad variations among fields and institutions in the degree and kinds of these problems investigators face, but, in my view, our nation's best research and teaching faculties, particularly our young investigators, are increasingly pressured by a lack of available resources.

Many able young faculty, once appointed to a tenure line appointment, often then face the difficult challenge of equipping and operating the research laboratories, often with little or only token assistance from either their department or institution. Not long ago young faculty members received from their departments and universities relatively small, but still -sufficient sums to start their research programs. These start-up finds provided a base from which to launch a competitive research project. Now, many departments and institutions, public and private alike, lack the resources necessary to provide young faculty with more than token start-up support. Successful candidates now appointed to leading departments may find little more than four bare walls awaiting them. From that

point, they begin the difficult job of building an internationally competitive research program, one which they hope some years later may result in the award of a fully-tenured faculty position.

Young investigators are further hampered by the absence of modern tools to do competitive, front-line research. The analytical power, and hence the research productivity, of sophisticated research instrumentation is rising at a dizzying rate. So too, however, is the cost. Investigators who are successful in the competition for project funds often find their requests for their tools, instruments, and equipment deleted from project proposals. Many are severely hampered in their ability to mount a competitive research career. Valuable time is often lost. As a result, individual researchers are placed at a disadvantage in the race to produce the quality and volume of research which would demonstrate productivity sufficient to merit a permanent, tenured position.

For these reasons we enthusiastically support the Administration's FY 1981 budget request to increase NSF and agency support for basic research programs. In particular, we urge your support for the new $14.25 million program to begin renovation of academic laboratories and for the increases proposed for instrumentation and equipment programs. (The NSF science education and faculty development programs interlinked with the research programs also play a vital role. Their continuation and development deserve your support.)

If one adds to the circumstances I have described the roles of being a wife, mother and woman in a traditionally male-dominated environment, the odds against success for even the most talented young women investigators can seem impossibly high. It is here that Congress might, through S.568, target a special effort that would have a salutory and direct result.

We urge that the Committee consider, as an addition to the bill, a program of National Research Awards for Young Women Scientists. We suggest a program

targeted on the early years of a young investigator's career when it can maximize the opportunities for long-term career success. Experience has shown that a successful program would have the following features:

- three-year, one-time renewable, or one-time, five-year research awards, in the range of between $10,000 and $70,000 per year and tailored to the needs of the discipline.
- recipients selected by a national merit competition, administered by the National Science Foundation, open to young women scientists within two to five years of the Ph.D.
- funds to be used for research, as determined by the scientist, for purposes including purchase, acquisition, operation and maintenance of instrumentation and equipment, laboratory renovation and research time
- a $5,000 institutional cost allowance to the host university to provide for administrative and overhead costs incurred by the fellow

The initial-year cost of a program of 30 awards per year would be approximately $2 million. The program should provide the researcher with essential stability of support. Either five-year, one-time awards, or three-year, once renewable awards, would target federal funds in an optimal way at a critical point in the careers of young scientists.

This mechanism is not new. It has been proven effective and has been time-tested in both federal and non-federal programs. It is a modest investment, but one, we believe, that would return to the nation rewards disproportionate to the to the relatively modest cost involved. I would urge the Committee to provide for such a program as a way to encourage and maximize the chances of our very best young women scientists to pursue long-term productive careers in science and engineering.

I want to thank the Committee for the opportunity to present these brief remarks. I would be happy to respond to questions.

Senator METZENBAUM. Thank you very much.

I will withhold my questioning until I have heard from each of the panel members.

Dr. Malcom, we're happy to have you with us.

Dr. MALCOM. Thank you for the opportunity to come before this subcommittee and speak to the women in science legislation.

I am Shirley Mahaley Malcom, program head of the Office of Opportunities in Science of the American Association for the Advancement of Science (AAAS). In this capacity I coordinate the various activities of the office aimed at increasing the participation and improving the status of minorities, women, and the physically handicapped in science careers. The office was established by the AAAS in 1973 to address the problems of minorities and women in science. In 1975, the concerns of the handicapped in science were added to our mandate.

The history of AAAS' concern for women in science is a long one. Not only does the office undertake activities and research on issues related to women in science, but women are represented throughout the organizational structure of the association and its board of directors, serving in 5 of the 11 elected board positions.

Out of this history of concern that embodies the office which I now head, and as a minority woman scientist, I come to you to speak to the legislation on women in science which is now before you for consideration.

I commend the subcommittee for the modifications which it has made to previous versions of the women in science bill. The proposed legislation has been made strong by the changes and is now a plan for positive action to address the problems of women's access to science. As the bill stands, it is very much in accord with the AAAS position regarding overcoming barriers to women in science. I therefore strongly endorse the intent and form of the proposed legislation.

It is a real and serious problem when the majority of the population which is female represents a minority of the science and engineering work force. It is a real and serious problem when this underrepresentation has come about in large part because of acts of omission or commission in the education and training of young women. It is a real and serious problem when women who have somehow overcome the myriad obstacles placed in their way during training for science careers find additional frustration, being more likely to be underpaid, underrated, undervalued, and under thumb—unemployed, untenured, and unrecognized.

Barriers to women in science exist everywhere—in access, in training, in employment, in the work place, and in career advancement. Women scientists in the Federal Government are paid less than men in the same positions. Women scientists in academia are overrepresented in off-tenure line positions. Young women are still being counseled out of science and mathematics courses in high school.

The remedies to problems especially of access and training, which have kept women out of science, remedies which are being proposed by the present legislation, involve science programs, not social programs. It is not just a matter of rightness or equity, but also a matter of the substance, content, and processes of science. It

will make a difference to science when women can become full participants. This issue of the impact of women's full participation has already been commented on regarding its application to health care by Dr. Anne Briscoe in previous testimony on this bill.

Present programing efforts on behalf of women in science are inadequate to bring about the changes within institutions which must occur if recent gains are to be maintained and expanded.

At present these efforts are neither adequate in scope nor in level of support. While it may be the policy of an agency to integrate the concerns for and activities directed at women into regular programing efforts, such policy usually depends on the beneficence of the person—usually man—in charge.

Concern for and emphasis on underrepresented groups within regular program structure are necessary, but they are not sufficient. There is also the need for additional efforts, specific and targeted. Current budgets for related programs within the agencies which are dealing with women's access to science are not sufficient to stand much more rerouting and rearrangement without resistance and resentment from the science community. New programs and new money for these programs for women in science are therefore needed.

It is important that minority women and disabled women are included specifically in programing efforts. As groups who face double discrimination, their unique problems must be addressed specifically, as well as those problems of access and advancement which they share with all other women.

It is tempting to lump all groups together who have faced and continue to face discrimination in science, but such seemingly simple solutions should be avoided unless it is appropriate to address their problems together.

Although these groups and others share discrimination, the history of the discrimination, the nature and the results of the discrimination, and the solutions to the problems brought on because of the discrimination, are not necessarily the same.

For programs to work, they must first be appropriate to the problems as they exist and as they originated. The legislation as proposed is appropriate to address problems of women in science. It does not include everything that should be done. It is focused mainly on the things that cost money. Responsibilities for bringing about full participation of women in science must be shared by all involved. Removing barriers to women in science will require conscious and conscientious efforts on the part of schools, colleges, universities, industry, the media and professional associations, as well as Federal, State, and local governments.

I will be glad to answer any questions you might have.

Senator METZENBAUM. Thank you very much, Dr. Malcom.

Our next witness is Margaret Dunkle. We would be happy to hear from you.

Ms. DUNKLE. Thank you, Senator.

I appreciate the invitation to the Federation of Organizations for Professional Women to testify this morning on the Women in Science and Technology Equal Opportunity Act.

I am Margaret Dunkle, president of the federation.

I would like to summarize my testimony this morning and ask that my complete testimony, along with the five attachments, be included in the record.

Senator METZENBAUM. Without objection, it will be so ordered.

Ms. DUNKLE. The Federation of Organizations for Professional Women is a nonprofit organization committed to promoting equal opportunity in education and employment for women. The membership of the federation includes, but is not limited to, a large number of organizations whose primary concern is science and technology, as well as the women's caucuses or committees of a number of academic associations whose primary concern is science or technology.

One of the major activities of the federation is the women and health roundtable, which provides policy information on this important issue. Additionally, the federation has been active in monitoring the enforcement of title IX and the laws guaranteeing equal employment opportunity to women. The federation is one of the original plaintiffs in *WEAL, the Federation, et al.,* v. *Harris.* This legal suit is the major reason why HEW has made some progress in enforcing title IX.

Bias and stereotyping of society at large, as well as overt discrimination, put constraints on both the aspirations of girls and the employment options of women. In no areas are these constraints more evident than in science and technology, and that is why we are here this morning.

The previous witnesses have very admirably documented that problem. So I will not reiterate those points that they made so well. I do have a couple of attachments to my testimony, including a National Academy of Sciences study that just came out this year which further document those statistics, and a couple of short papers on the status of women in science and technology at women's colleges which I think provides an interesting sidelight.

I would like to spend the rest of my time commenting on specifics in the bill.

The federation strongly supports the legislation which you are addressing this morning. Many of the women who participate in the federation have been personally, severely, and profoundly affected by both the subtle sex bias and the overt sex discrimination that this bill attempts to reduce or eliminate.

Although many of these women have overcome these barriers, the road has been difficult for most of them. As Senator Kennedy said when he introduced the bill last March, "We have a scientific work force which is dangerously close to being an all-male club * * * This situation is far too disturbing to be written off as the natural outcome of an educational and career ladder on which advancement is based solely on merit."

Let me address some of the points in the bill which we feel are especially important. Additionally attached to my testimony, appendix A, is a rather lengthy section-by-section comment on the bill, that which will be included in the record.

I would like to emphasize that, although these comments are fairly lengthy, they are merely improvements or clarifications. They do not offer major substantive or directional changes in the bill.

First, we believe that the bill will be effective in eliminating much of the discrimination and stereotyping, as well as many of the specific barriers which limit both full employment opportunity for women in the science and the aspirations of young women with scientific talent.

Second, we believe that organizations specifically concerned with the advancement of women in science need to be closely involved in all of the activities authorized under this bill. That provides an important system of checks and balances without which the bill cannot be maximally effective.

Third, I want to stress the employment focus of the bill. We believe that the aspirations of young women students to pursue careers in science and technology will increase in direct proportion to the improvement of the employment situation in these fields for women. Therefore, we urge a strong emphasis on elimination of bias and discrimination in employment.

There is also one specific point I would like to mention. We think a clarification in section 413 would be helpful regarding visiting women professors. A new section 413(d) should be added, saying that institutions cannot count visiting women professors in their affirmative action or equal employment opportunity statistics.

Fourth, we support the efforts in the bill to assure that reentry women have access to the services and benefits of the bill.

Fifth, we support the efforts in the bill to coordinate the activities regarding women in science with other related activities and programs. We do not believe that this bill duplicates or contradicts existing programs. Rather, we think it can provide a thoughtful complement to these programs.

Sixth, we support wide dissemination of all the materials and data developed under the bill.

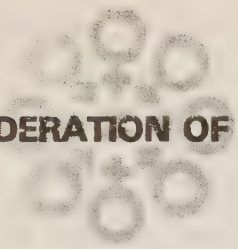
Seventh, the data collection and analysis components of the bill are vital. We support having the Equal Employment Opportunity Commission responsible for the employment data collection. However, this section of the bill would be vastly improved by requiring data by sex and race simultaneously, rather than just by sex.

Eighth, we support the overall provisions in the bill to assure that the unique situation of minority women and handicapped women is identified and the efforts of the bill to address this.

In summary, we strongly support the Women in Science and Technology Equal Opportunity Act, and we urge its adoption. Our country cannot continue to be denied the scientific talents, creativity, and skills of women. We believe that the bill provides a mechanism for exerting thoughtful and effective leadership to assure that women and girls have full and equal access to use their scientific and technical talents.

Thank you.

[The prepared statement of Ms. Dunkle with attachments follows:]



FEDERATION OF ORGANIZATIONS FOR PROFESSIONAL WOMEN

TESTIMONY OF

MARGARET C. DUNKLE, PRESIDENT

FEDERATION OF ORGANIZATIONS FOR PROFESSIONAL WOMEN

ON S.568

"WOMEN IN SCIENCE AND TECHNOLOGY EQUAL OPPORTUNITY ACT"

BEFORE THE

SUBCOMMITTEE ON HEALTH AND SCIENTIFIC RESEARCH

OF THE

SENATE COMMITTEE ON LABOR AND HUMAN RESOURCES

MARCH 3, 1980

2000 P Street N.W., Suite 403 • Washington, D.C. 20036 • 202/466-3547

I appreciate the invitation to the Federation of Organizations for Professional Women to testify today regarding S.568, the "Women in Science and Technology Equal Opportunity Act.

I am Margaret C. Dunkle, President of the Federation. Until recently, I was a special assistant for legislation at HEW. Previously, I was chair of the National Coalition for Women and Girls in Education, and Associate Director of the Project on the Status and Education of Women of the Association of American Colleges.

The Federation of Organizations for Professional Women

The Federation of Organizations for Professional Women is a non-profit organization committed to promoting equal opportunity for women in employment and education. Over sixty organizations are affiliated with the Federation in an attempt to reach this goal.

The Federation was formed in 1972 to provide a mechanism for women in the professions to join together around issues affecting equal opportunity for women in education and employment. Although much of the impetus for beginning the Federation came from women doctorates in the sciences, the scope and membership has continued to broaden over the years so that it now represents women in the humanities, arts, social services, business, and academia as well.

The membership of the Federation continues to include a large number of organizations whose primary concern is science and technology. For example, the following organizations are Federation Affiliates:

Association for Women in Mathematics
Association for Women in Science
Graduate Women in Science/Sigma Delta Epsilon
Nuclear Energy Women
Society of Women Engineers
The New York Academy of Sciences

Additionally, a number of the women's caucuses or committees of academic associations which are affiliated with the Federation are in the sciences. These Affiliates include:

American Association for the Advancement of Science
  Women's Caucus
American Association for Higher Education
  Women's Caucus
American Association for Women Podiatrists of
  the American Podiatry Association
American Chemical Society
  Women Chemists Committee
American Physical Society
  Committee on the Status of Women in Physics

American Psychological Association
Committee of Women in Psychology
American Society of Biological Chemists, Inc.
Committee on Equal Opportunities for Women
American Society for Cell Biology
Women in Cell Biology
American Society for Microbiology
Committee on the Status of Women Biologists
American Statisticians Association
Caucus for Women in Statistics
Association for Women in Mathematics
Women's Research Center
Biophysical Society
Women's Caucus
Commission on the Status of Women in the Economics Professions
History of Science Society
Committee on Women
Institute of Electrical & Electronics Engineers
Committee on Professional Opportunities for Women
Joint Committee on the Status of Women
Harvard Medical Area

One of the major activities of the Federation is the Women and Health Roundtable, which provides information on this important issue to health policymakers, health researchers and others concerned about public policy issues affecting women's health.

The Federation has also been actively concerned with the effective implementation and enforcement of Title IX of the Education Amendments of 1972, the landmark legislation guaranteeing equal education opportunity to girls and women. The Federation is one of the original plaintiffs in the suit, WEAL, the Federation, et al., v. Harris. This suit has been the major reason HEW has made progress in enforcing Title IX.

However, even if HEW or the Civil Rights arm of the new Department of Education were to enforce Title IX vigorously (which they have not yet shown signs of doing), there would still be bias and discrimination in education which limit the opportunities of girls in school. (As an aside, I might add that sex bias and discrimination also limit access of boys to certain areas. However, by and large, boys are discouraged from going into low status, low-paying "female" areas.)

Sex Discrimination and Bias in Science and Technology -- The Problems Are Far From Being Solved

All of the instances in which opportunities are limited for women and girls are not the result of direct discrimination; rather, bias and stereotyping in society at large put constraints on both the aspirations of girls and the employment options of women. In no

areas are these societal constraints more evident than in science and technology.

Recent figures show that, while women have made progress in the sciences, they are still a long way from being equal in numbers, status, or salary to men. The National Academy of Sciences, in a 1980 report,"Women Scientists in Industry and Government: How Much Progress in the 1970's?" reported the following regarding women in industry (1977):

- A quarter of all male scientists and engineers in the Ph.D. work force, but only 7% of such women, held positions in industry in 1977.
- Male doctorate-holders were twice as likely as comparable women to be in managerial positions.
- Although the starting salary differential for women Ph.D.s has been significantly reduced, the pay differentials for women scientists who are past this first step are substantial. Men typically earn $7,500 more than women among older Ph.D.s, and $4,000 more in the mid-career group. As a matter of fact, for the mid-career scientists and engineers the female/male salary differentials were noticeably larger in 1977 than they were in 1973.
- The sex differences in hiring rates and salaries are most marked in the life sciences where the pool of women doctorates is relatively large.

The National Academy of Sciences reports the following for women in the Federal government:

- Between 1974 and 1978, the number of women scientists and engineers in the federal government grew from just under 8,000 to nearly 12,000 -- a 50% increase. At this same time, total federal employment of such personnel increased only 16% (from 134,700 to 156,200).
- Women now account for one in 13 of the federally employed scientists and engineers at all degree levels and one in 20 of the Ph.D. personnel.
- Approximately 21% of the women scientists and engineers (compared to 45% of the men) were above the GS 13 level in 1978.
- The proportion of women scientists and engineers at the upper levels (GS 15 to 18) increased only 2.4% from 1974 to 1978.

- Although women scientists and enigneers were promoted to a higher grade and to management positions at a faster rate than their male counterparts between 1974 and 1978, women still only hold about 500 of the 17,600 federal managerial jobs -- less than 3%.

- Salary differences for women and men scientists and engineers remain substantial -- $4,300 in the mid-career (age 40-44) in 1978. This difference exists despite the fact that women's earnings climbed somewhat more rapidly than men's over this period.

- Among the new accessions, women scientists were typically hired at a lower grade and a lower salary than comparable males. This pattern was found at all degree levels and regardless of the number of years since the degree was earned.

- Sex differences in starting salaries for new Ph.D.s in government are slight, but for those least six years past the doctorate this differential grows to at least $2,400.

- For recent bachelor's and master's degree holders, sex differences in starting salaries and grade levels remain large, with men earning almost 20% more than women.

A copy of this report is attached to my testimony -- Appendix C.

I am also attaching some specific information regarding the employment situation of women at the National Institutes of Health -- Appendix E.

Perhaps not surprisingly, women in the sciences have, by and large, fared better at women's colleges than they have a coeducational institutions. In a 1979 survey of women on the biomedical faculties of women's colleges, the Women's College Coalition found that:

- 54% of all biomedical faculty members were women.

- 51% of all full-time biomedical faculty were women.

- Half of the science faculty receiving funds for research were women, and

- 61% of the biomedical faculty were involved in research projects or research training projects with undergraduate students, thus providing front line science training for women undergraduates.

A more complete summary of this study is attached to my testimony -- Appendix B.

Additionally, attached is an article from Science Magazine on "Baccalaureate Origins of American Scientists and Scholars," by M. Elizabeth Tidball and Vera Kistiakowsky -- Appendix D.

The Bill -- Comments and Suggestions

The Federation strongly supports the legislation which you are sponsoring and which we are addressing this morning -- S.568, the "Women in Science and Technology Equal Opportunity Act." Many of the women who participate in the Federation have been personally and profoundly affected by both the subtle sex bias and the overt discrimination that this bill attempts to reduce or eliminate.

Although many of these women have overcome these barriers, the road has been rocky and difficult for them. As Senator Kennedy said when he introduced the bill last March 7, 1979:

> For 50 years educational, institutional, and cultural barriers have stood in the way of the participation of women in careers in science and technology. For 50 years we have systematically shut the doors on scientific careers for women by the time they were 17 years old. For 50 years women have been denied equal educational and employment opportunities in science and technical fields. As a result, we have a scientific work force which is dangerously close to being an all male club.

We wonder, as Senator Kennedy did when he introduced the bill:

> How many breakthroughs in science might have come from the 50 percent of the population which has been so arbitrarily discarded? How much more rapid might have been our advances in areas of national concern? How many Nobel prizes might have been won? And how different might have been our present perceptions about the role of women in medicine, science, and engineering? ... This situation is far too disturbing to be written off as the natural outcome of an educational and career ladder on which advancement is based solely on merit.

Let me address some of the points in the bill which we feel are especially important. Additionally, I have included an appendix (Appendix A) which suggests specific clarifications, improvements and changes. While this appendix is fairly lengthy, please note that the comments are suggested improvements or clarification, not major substantive or directional changes.

- We believe that the bill will be effective in eliminating much of the discrimination and stereotyping,

as well as many of the specific barriers, which limit both full employment opportunity for women in the sciences and the aspirations of young women with scientific talent.

- We believe that organizations specifically concerned with the advancement of women in science need to be closely involved in all of the activities authorized under this bill -- from the identification of appropriate activities, to active involvement in the Committee on Women in Science, to having ready access to the data compiled or developed under the bill.

- We believe that the aspirations of women students to pursue careers in science and technology will increase in direct proportion to the improvement of the employment situation in these fields for women. Therefore, we urge a strong emphasis on eliminating bias and discrimination in employment in carrying out the activities of the bill. We additionally urge that the efforts to encourage girls and women to enter scientific fields emphasize developing and expanding employment areas and fields, rather than traditionally female areas or fields which are not likely to provide substantial employment opportunities in the future.

- We support the efforts in the bill to assure that re-entry women -- women entering the work force or women pursuing their education later than the traditional 18 to 22 age -- have access to the services and benefits of this bill.

- We support the efforts in the bill to coordinate the activities regarding women in science with other related activities and programs. We do not believe that this bill duplicates or contradicts existing programs. Rather, we believe that it is a thoughtful complement to both the laws prohibiting sex discrimination in education and employment, as well as other federal programs which encourage the full participation of women.

- We support wide dissemination of all of the materials and data developed under, and for, this act. The information on women in science will be invaluable to a wide range of people concerned about full utilization of women in science and technology. We additionally support the transmittal of the report of the Committee on Women in Science to the Congress.

- The data collection and analysis components of the bill are vital. However, these sections would be vastly improved by requiring collection of data by sex/race, rather than just by sex. The barriers which

face minority women are often different in degree or dimension from the barriers which face majority women. It is important to identify these differences so that they can be effectively addressed.

- Similarly, we support the overall provisions to assure that the bill identifies the unique situation of minority and handicapped women -- and the efforts in the bill to address specific problems that these women face. The bill effectively addresses the issues affecting women, recognizes the unique situation of minority women, and provides a good complement to efforts specifically aimed at increasing participation of minorities in the sciences.

In summary, we strongly support the "Women in Science and Technology Equal Opportunity Act," and we urge its adoption. Our country cannot continue to be denied the scientific talents, creativity and skills of women. It is inconsistent with the principles of equal opportunity on which our country was founded to allow discrimination and bias against women and girls with these scientific talents to continue. We believe that this bill provides a mechanism for exerting thoughtful and effective leadership to assure that women and girls have full and equal access to scientific and technical careers.

* * * * *

Attachments:

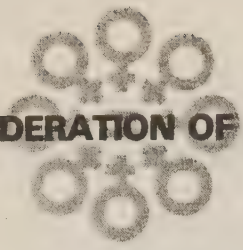
Appendix A -- "Specific Comments and Suggestions Regarding S. 568, the 'Women in Science and Technology Equal Opportunity Act.'"

Appendix B -- "Report of the Women's College Coalition Survey of Biomedical Research Activity in Undergraduate Women's Colleges," Women's College Coalition, 1979.

Appendix C -- "Women Scientists in Industry and Government: How Much Progress in the 1970's?, National Academy of Sciences, Interim Report to the Office of Science and Technological Policy, from the Committee on the Education and Employment of Women in Science and Engineering, 1980."

Appendix D -- "Baccalaureate Origins of American Scientists and Scholars," from Science Magazine, M. Elizabeth Tidball and Vera Kistiakowsky, August 1976.

Appendix E -- Information Regarding the Employment of Women at the National Institutes of Health.



FEDERATION OF ORGANIZATIONS FOR PROFESSIONAL WOMEN

APPENDIX A

SPECIFIC COMMENTS AND SUGGESTIONS REGARDING

S. 568

"WOMEN IN SCIENCE AND TECHNOLOGY EQUAL OPPORTUNITY ACT"

NOTE: The section numbers, and page and line references refer to the January 25, 1980 Committee print of the bill.

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Findings (Section 101, Page 27, line 26ff)

Although the statement of findings in the bill presents a dismal picture regarding the current status of women in science and technology, it is nontheless an accurate picture. It is also a picture which makes a strong case for federal initiative and leadership. Women are seriously underrepresented in these fields and multiple discrimination especially works to limit the full participation of minority women, handicapped women and older women.

Purpose (Section 102, Page 29, line 2ff)

The Declaration of Purpose is very well constructed. It recognizes that, in addition to increasing the number of women in scientific careers, it is necessary to ensure opportunities for employment and advancement of women scientists in the current resource pool. It also recognizes that minority and handicapped women have special needs and that there is a necessity to educate and inform the public about the importance of the participation of women in science.

I should like to note the special importance of the second "purpose" -- to increase opportunities for the employment and advancement of women in science and technology. Without real jobs and employment opportunities, the other purposes (better preparation of women in these fields, increased literacy of women in science and mathematics, public information, etc.) cannot be fully met. Although changing employment patterns is the keystone of changing the aspirations of young girls and public opinion, it is also the most difficult goal to attain. It requires paying women more, promoting them to policy and responsible administrative positions, funding them to be principle investigators, and putting them in positions of real power and responsibility.

Policy (Section 103, Page 29, lines 22ff)

This section incorporates a number of important issues for women in science and technology. We especially applaud Subsection 5 (Section 103(5), Page 30, line 6ff), which says that activities under this Act shall "provide for the participation of professional associations and groups with expertise in the advancement of women, especially associations and groups involved in the advancement of women in science and technology." This provision is essential because close involvement of, and careful monitoring by, outside groups whose primary concern is equal opportunity for women are vital components of genuine efforts to effect constructive institutional change. An informed outside constituency, working with the government policymakers and administrators responsible for implementing the programs, produces a healthy system of checks and balances.

We support purpose #8 (Section 103(8), Page 30, line 16ff), which emphasizes fields in which the underrepresentation of women is most serious and in which existing public and private activities are insufficient. We recognize that this, unfortunately, includes virtually every field in science and technology. Even in fields where women are not as significantly underrepresented in the entire field, women are almost always underrepresented at the highest and most responsible levels of these fields. Therefore, we urge you to add report language indicating that if resources from this act are used in fields in which women are not seriously underrepresented in the entire field, these resources be concentrated on upward mobility of those women in the field, not on encouraging still more women to enter the field.

We also support the provisions in the Statement of Policy (Section 103 (2)&(3), Page 29, line 33ff and Page 30, line 1ff) which provide for making maximum use of existing federal programs and providing for coordination with these programs in carrying out the act. While none of the other federal programs aimed at assuring non-discrimination and sex equity would duplicate or necessarily overlap with this act, efforts at coordination are important to assure that the various programs to promote sex equity are complementary.

We also believe that purpose #4, to use the expertise of women already in these fields (Section 103(4), Page 30, line 4-5), is important. These women have first-hand knowledge regarding the rewards and problems that face women in science. Additionally, only they can provide a role model to women students considering entering scientific fields.

Several minor points regarding this section:

- It would be helpful to clarify the term "institutional change" (found in Purpose #7, Page 30, line 14), perhaps through report language, indicating that the term "institutional change" includes changes in educational institutions at all levels; research and scientific facilities in educational institutions, the private sector, and the government; and employment patterns and practices in both the public and private sector.

- It might be useful to expand Purpose #9 (Page 30, line 20ff), regarding encouraging cooperative relationships, to include government and the private (non-industrial) sector, as well as the industrial and academic sectors. This same comment applies to other sections of the bill where the "industrial and academic sectors" are specifically mentioned.

Elementary and Secondary Programs (Section 201, Page 31, line 3ff)

We believe that this section is well constructed and conceived. We believe that it is important to encourage young girls to gain scientific and mathematical skills early in their educational careers, even if they do not choose to pursue a scientific or technical field. As the bill indicates in Section 201(b)(5) (Pages 31-32), these skills are important for entry into a host of careers.

We support the provisions (contained in Section 201(a) to authorize grants and contracts to strengthen elementary and secondary school programs in science and mathematics. We applaud the fact that the definition of entities eligible for these grants and contracts is sufficiently broad to include businesses owned by women.

We support this same language in the section on higher education programs (Section 202(a), Page 32, line 8), continuing education programs (Section 203(a), Page 33, line 23), and elsewhere in the bill.

We would like to see report language stressing the importance of consulting with women's associations and organizations during the consultation with "public agencies and private entities" required of NSF before awarding funds. (See Section 201(a), Page 31, line 6-7.) These programs are likely to be the most effective if their implementation is preceeded by thorough discussions with the intended beneficiaries of this bill -- women and girls, especially women and girls in the sciences.

We similarly support report language of this type referring to higher education programs (Section 202(a), Page 32, line 7-8), continuing education programs (Section 203(a), Page 33, line 22), the Center for Women in Science (Section 301(a), Page 34, line 23), and elsewhere in the bill.

Higher Education Programs (Section 202, Page 31, lines 5ff)

This section (202(a)) covers the wide range of activities appropriate to this educational level. We believe that the Section (202(a)(4), Page 32, line 14ff) which indicates that the program is to provide continuing education and retraining opportunities for women whose careers have been interrupted is especially important.

A number of women with scientific or technical talents did not pursue these talents in their earlier education because of discrimination, stereotyping and a desire not to be the lone woman in an occupation or class. Additionally, even women who did pursue these fields in their earlier education often find themselves re-entering the job market today with obsolete information

after divorce or the death of their husband. These women need to be retrained so that they can use their skills and abilities as fully as possible.

We believe that the provisions aimed at strengthening the scientific and technical skills of students whose primary field of study is not scientific or technical are extremely important. Familiarity with these areas provides important flexibility which facilitates future mobility and increased career options. (Section 202(b)(2), Page 32, line 24ff).

Regarding the provisions of fellowships and career development grants (Page 33, line 1ff), we strongly support the provisions allowing eligibility "without regard to when the individual received an undergraduate degree." Because women returning to the work force or re-entering college often have financial problems (as well as credentialing problems), it is important that these women be eligible for these awards. We also support these provisions for continuing education programs (Section 203(b)(2), Page 34, line 5-6) and elsewhere in the bill.

While such fellowships and grants are a useful component of a comprehensive effort to increase women's participation in science and technology, it is important that they be viewed and funded in context -- as part of the whole program.

We believe that the basis for determining stipends for individuals need not appear in the bill itself (Section 202(d), Page 33, line 15ff). Such a specification could be left to report language or the discretion of the Foundation. Perhaps the most important factor -- which should be specified in report language -- is that the factors which determine stipend size not discourage re-entry women or women with family responsibilities from pursuing scientific careers.

We believe the provisions for continuing education programs should be similarly treated (Section 203(c), Page 34, line 10ff).

Continuing Education Programs (Section 203, Page 33, line 20ff)

We support the provisions in Section 203(a) which encourage women who re-enter the work force to pursue new knowledge and skills in scientific fields (Page 33, line 21ff).

Regarding activities supported by this section, we would suggest that report language clarify that the term "educational techniques" includes efforts to change institutional policies and practices which discourage continuing education for women in the sciences and technology.

Center for Women in Science (Section 301, Page 34, line 18ff)

A Center for Women in Science will provide a positive mechanism to promote increased opportunities for women in science. We especially support the encouragement in the bill for the Center to work with groups active in the promotion of increased opportunities for women in science (Section 301(b), Page 34, line 26ff).

We would suggest expending Section 301(b)(2) (Page 34, line 33ff) to include activities designed to "alleviate discrimination, bias and stereotyping against women in science and technology. This is important because more subtle bias and stereotyping, as well as overt discrimination, severely limit opportunities for women in these fields.

The bill indicates that the Center will work cooperatively with "appropriate public agencies." We assume that the Center, which is charged with informing the public about the issues and identifying activities aimed at opening science fields to women, will work closely with the agencies charged with enforcing equal opportunity provisions in the law (Title IX of the Education Amendments of 1972 with regard to educational opportunity; and Title VII of the 1964 Civil Rights Act, the Equal Pay Act, and Executive Order 11246 with regard to employment opportunities). Such a cooperative relationship is essential, since incentives for positive change, such as those provided in the bill, complement effective and fair enforcement of laws barring discrimination.

Research Program (Section 302, Page 35, line 29ff)

We support the research program and are especially interested in the provisions designed to increase understanding of "the means to facilitate the participation and advancement of women" in these fields (Section 302(a)(2), Page 35, line 33ff). It is especially important both to identify effective ways to end discrimination and bias, and to make this information readily and widely available to so that it can be used and constructive change can be implemented.

Dissemination (Section 303, Page 36, line 6ff)

Wide dissemination of the materials, data and research is essential in order to affect schools, colleges, employers, and the public.

Media Projects (Section 304, Page 36, line 11ff)

We believe that the media projects activity outlined in the bill can be extremely useful. Such projects could do much to eliminate the often unconscious bias in society that tracks women out of careers in the sciences.

Although the section dealing with media projects does not specify the administrative location of this activity, we urge an administrative structure which is strongly linked to, or coordinated with, the Center (which also has as one of its goals "activities to educate and inform the public").

Books and Instructional Materials (Section 305, Page 35, line 30ff)

We support this section. The presentation of girls and women in books and instructional materials plays an important, although often subtle, role in shaping the aspirations of girls and the expectations which others have of girls and women.

Since schools replace their text books and instructional materials infrequently, we would suggest the addition of report language indicating that an allowable interim activity would be to develop materials to supplement existing textbooks. These supplementary materials should either balance the treatment of women in textbooks or provide specific guidance on how to use biased materials in a non-biased manner. Of course, the development of such interim materials is not, and should not be considered, a substitute for materials which are free of bias in the original. Hence, any interim materials should be developed in such a way as to maximize the chances that the biased publication will, when revised, be free of bias.

We also believe that there should be active efforts: (1) to disseminate this information to schools, organizations and individuals concerned about equal opportunity for women in science; and (2) to encourage the adoption and publication of these materials by textbook publishers.

Community Outreach (Section 306, Page 37, line 19ff)

We support the community outreach provisions and urge that they be closely coordinated with media projects and the activities of the Center.

Museum Programs (Section 307, Page 37, line 30ff)

We support these provisions.

Distinguished Achievement in the Advancement of Women in Science Award (Section 311, Page 38, line 6ff)

We support recognition of people -- female or male -- who have made outstanding contributions to the participation and advancement of women in science. We would hope that any such awards would be made with substantial publicity so that they would have the ripple effects of encouraging others to be supportive of women in the sciences, and encouraging girls and women to pursue scientific careers.

Mathematics and Science Incentive Awards (Section 312, Page 38, line 17ff)

We believe that providing incentives to schools which demonstrate a commitment to encouraging the enrollment of females in mathematics and science courses could, in some instances, be useful. However, we fear that the current criteria in the bill for these awards would be biased regionally and by the overall socio-economic level of the student body.

As a rule, we would encourage using funds under this act for specific projects, programs and activities, rather than as incentive awards.

Visiting Women Scientists Program (Section 313, Page 39, line 1ff)

We believe that this program provides an important mechanism both for providing female students with real-life role models and for providing women already in the sciences with professional exposure and experiences which they might not otherwise have.

We would hope that such a program would provide substantial "unstructured" or loosely structured time during which the visiting women scientists could talk informally with students regarding their aspirations, the experiences of the women scientists, etc.

Reporting, Data Collection and Demonstration Projects -- Definitions (Section 401, page 40, line 1ff)

Because of the importance of the definition of "scientific, technological and technical positions," we recommend that the words "in consultation with appropriate public and private agencies, as well as with groups active in the promotion of increased opportunities for women in science" be added in Section 401(b), following the words "Office of Management and Budget" (Page 40, line 23).

Depending on how the positions are defined, one could get a very different idea of the status of women in these areas. It is important that subfield distinctions be recognized since occupational segregation in the disciplines are all too often masked when the overall data are grouped by discipline only.

Reporting Required and Data Collection (Section 402, Page 40, line 26ff)

We believe that the data collection required by this section will be extremely useful in identifying problem areas, as well as methods for overcoming sex bias and discrimination in the scientific workplace.

The Equal Employment Opportunity Commission is the appropriate agency to collect these data. EEOC has authority over employment discriminaiton in both the private sector and government. Additionally, it is useful to have a third party gather this information in order to assure that it is collected and presented in a comprehensive, straightforward and nonbiased manner.

We cannot emphasize how strongly we believe that the data should be collected by sex and race simultaneously. Therefore, we suggest that the words "sex/race" be substituted for the word "gender" in Section 402(b)(1) (Page 41, line 7).

We also suggest that Section 402(b)(1)(A) be improved by revising the language to say "the number of individuals in permanent and temporary and in full-time and part-time scientific and technical positions; by GS level or similar category; by salary level; and by job category or ranking" (Page 41, lines 8-11).

Additionally, a new subsection (402(c)) should be added to provide for the publication of these data and to assure that the data are widely available to those concerned with equal opportunity for women in science and technology (Page 42, line 3).

Annual Report (Section 403, Page 42, line 4ff)

Again, we emphasize the need to gather and report data by sex and race simultaneously. Specifically, we suggest that Section 403(b) be revised to say: "The report required by subsection (a) shall contain an accounting and comparison, by sex/race and by discipline" etc. (Page 42, lines 16-17).

Because it is important for the report of the Director to be available to the public, a new subsection (403(d)) should be added which reads: "The Director shall make the report required by subsection widely available to the public." It is important that this report (as well as the EEOC data report) be easily available so that the public clearly knows the facts about women's participation -- and non-participation -- in these areas.

Federal Government Training for the Encouragment of Women in Science (Section 411, Page 43, line 8ff)

We support these provisions.

Demonstration Projects (Section 412, Page 43, line 20ff)

We support these provisions.

Visiting Professorships for Women in Science (Section 413, Page 44, line 12ff)

Regarding the visiting professorships for women in science, we recommend report language making clear that an institution's participation in this program must be augmented by other institutional efforts (especially hiring of women faculty) to provide women in science with a more equitable position.

Additionally, an institution should not be allowed to count federally funded visiting women professors to make the campus representation of women scientists appear to be more equal than it in fact is. Because of the small size of many departments, being able to count visiting women professors in affirmative action and EEO statistics would be misleading and would substantially skew these statistics. Therefore, we strongly believe that a section to this effect should be added to the bill (a new section 413(d) specifying that institutions cannot count these visiting women professors in their affirmative action statistics).

Committee on Women in Science (Section 501, Page 45, line 3ff)

We believe that, in order for this committee to provide the most useful guidance, it is essential for it to include representatives of outside organizations and association who have been active in promoting equal opportunity for women in

science. We strongly support the provisions in the bill which specify this (Section 501(b), Page 46, line 15ff).

The bill should specify that the Special Assistant for Women in Science is a "Special Assistant to the Director for Women in Science" (Section 501(g), Page 47, line 15). It is essential that this special assistant be in the immediate office of the Director.

We support the provision in the bill which requires for a report to Congress by the Committee (Section 501(i), Page 47, lines 32-33).

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1979

APPENDIX B: REPORT OF THE WOMEN'S COLLEGE COALITION SURVEY OF [redacted] BIOMEDICAL RESEARCH ACTIVITY IN UNDERGRADUATE WOMEN'S COLLEGES

A survey instrument (see attached) was developed by the Biomedical Research Opportunities for Women (BROW) Work Group to provide the study group with information regarding current biomedical research activity at women's colleges. The questionnaire was mailed in early March to member presidents of the Women's College Coalition, a voluntary organization of 67 women's colleges nationwide. Presidents of the institutions were asked to obtain relevant data from department chairs in the following fields: biology, zoology, botany, biochemistry, organic chemistry, and chemistry. Of the 66 institutions surveyed, 4 were later judged to be inappropriate to the study since they are two-year institutions. Of the remaining 62, 46 or 74% responded to the survey. 19 of the institutions responded for two separate departments giving a total of 65 departments represented in the findings. The sample comprises independent and church-related institutions, urban and rural, highly selective and less competitive, large (over 2,000) and small (under 500) institutions nationwide.

The study revealed that women faculty members at women's colleges were typically full-time faculty members (73%) involved in research projects (45.3%) and in research participation/training with undergraduate students (61%). Approximately 4.6 women students in each department responding are engaged in research with faculty, and an average of 2.8 women faculty at each department are working with women students on research projects. Significant publications activity was reported by a number of the colleges. Of those women faculty engaged in research, 41.2% are involved in collaborative activities with colleagues. Relative to their enrollment size (which is typically small), the responding institutions show a healthy percentage of student majors in the biomedical sciences.

Some highlights from the survey are outlined below:

- Women constituted 54% of the total science faculties of responding institutions, 51% of the full-time faculty and 66% of the part-time faculty
- 64% of all women faculty at these institutions held earned doctorates
- 51.1% of the faculties at women's institutions are engaged in research activities and nearly one half (48.5%) of those so engaged are women
- One half of those faculty receiving external support for research (14.7% of the total faculty) are women
- 18.7% of all women faculty are engaged in collaborative research
- The average department size for a responding institution was 4.9 full-time faculty and 1.3 part-time faculty members
- 61% of the women faculty are involved in research participation/ training with undergraduate students

WOMEN'S COLLEGE COALITION
Suite 1003 1725 K Street, N.W. Washington, D.C. 20006

APPENDIX C

Women Scientists in Industry and Government

How Much Progress in the 1970's?

Women Scientists in Industry and Government

How Much Progress in the 1970's?

An Interim Report to the
Office of Science and Technology Policy

From the
Committee on the Education and Employment
of Women in Science and Engineering

Commission on Human Resources
National Research Council

NATIONAL
ACADEMY OF
SCIENCES

Washington, D.C. 1980

NOTICE

The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the Councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the Committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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PREFACE

The Committee on the Education and Employment of Women in Science and Engineering was appointed by the Commission on Human Resources in December 1974. Its charge was to examine the social and institutional constraints that limit the participation of women in science and engineering and to serve as a focus for efforts to improve their utilization.

Since September 1977, the Committee's studies have been supported by the Office of Science and Technology Policy, Executive Office of the President. The Committee's first report to the OSTP entitled Climbing the Academic Ladder: Doctoral Women Scientists in Academe was published in April 1979. Included in the report were recommendations for improved utilization of women in faculty, postdoctoral, and advisory appointments.

This second, briefer report concerns the status of women scientists and engineers in private industry and the federal government. In particular, it examines the extent to which their employment situation has improved since the advent of affirmative action mandates. The report consists primarily of analyses of the available data on doctoral women. A more intensive study, examining industry hiring of women scientists at all degree levels and recommendations concerning their recruitment is now being planned.

Since its inception, the Committee has been chaired by Dr. Lilli S. Hornig, Executive Director, Higher Education Resource Services, Wellesley College.

ACKNOWLEDGMENTS

The Committee wishes to thank Gilbert S. Omenn, Associate Director for Human Resources and Social and Economic Services, Office of Science and Technology Policy, who has been the responsible liaison officer and has generously contributed to the work of the Committee.

Nancy C. Ahern, of the Commission on Human Resources served as Staff Officer for the study. Harrison Shull, Chairman, and William C. Kelly, Executive Director of the Commission, provided valuable guidance and support. Milda H. Vaivada, formerly administrative assistant to the Committee, was helpful in the early stages of the project. Michele R. Renfroe had responsibility for preparation of the final manuscript.

Staff of the U.S. Office of Personnel Management who assisted in providing data and helpful suggestions include Robert Penn, Workforce Analysis and Statistics Division, and Ruth Cullen, Office of Affirmative Employment Programs.

To these and all others who aided in the preparation of this report, the Committee expresses its sincere thanks.

CONTENTS

INTRODUCTION 1

SUMMARY OF FINDINGS 4

PART 1 DOCTORAL WOMEN SCIENTISTS AND ENGINEERS IN INDUSTRY 7
Supply of Women Ph.D.s 7
Employment Trends 8
Utilization by Field 9
Profile by Industry 10
Women Managers 11
Salaries 14
Educational Background 18
Financial Support During Graduate School 19
Quality of Men and Women Ph.D.s 19
Postdoctoral Training 20
Industry Hiring 21
Summary and Discussion 22

PART 2 WOMEN SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT . . 25
Utilization by Field 26
Grade Distribution 27
Senior-Level Positions 31
Promotions Between 1974 and 1978 31
Salary Increases 33
Women in Management 34
New Hires 34
Summary and Discussion 37

CONCLUSIONS AND RECOMMENDATIONS 39

APPENDICES 43

INTRODUCTION

The majority of doctoral scientists traditionally have been employed in colleges and universities, although with considerable variation by field. Since academic opportunities have shrunk in the last few years and are expected to decline more steeply in the next decade, a predictably strong interest in industrial and government employment has emerged. The extent to which these sectors will absorb a growing share of the Ph.D. population is not clear, however.

This issue is particularly relevant to employment prospects for women scientists. In the past decade the number of women who annually earn doctorates in the sciences has tripled, while overall Ph.D. production peaked in 1973 and has declined slowly since then. In addition, significantly greater proportions of women scientists than of men have relied historically on the academic job market, although they have characteristically been employed in untenured positions and in the lowest ranks.[1]

The rapid increase in the pool of highly trained women scientists has coincided with not only a decline in faculty openings, as noted above, but also with two other important developments: the emergence of affirmative action regulations and a change in social attitudes about the role of women. The combination of these events might be expected to result in an increased number of women in industry and government and improved opportunities for career advancement.

This leads to an important set of questions. To what extent are women scientists in fact moving into these areas? Which industries or federal agencies are hiring increasing proportions of women scientists? Do job functions differ by sex? Are women being promoted to management positions as frequently as men with the same training? Are salary differences narrowing?

About the report

This report to the Office of Science and Technology Policy presents data on the status of women scientists and engineers in private industry (Part 1) and the federal government (Part 2). In particular, it examines the extent to which their employment situation has improved in the 1970's. The Committee's findings with respect to women scientists in industry

[1] Committee on the Education and Employment of Women in Science and Engineering, Commission on Human Resources, National Research Council, *Climbing the Academic Ladder: Doctoral Women Scientists in Academe* (Washington, D.C.) National Academy of Sciences, 1979).

constitute an interim report to be followed by a more intensive study of recruitment and hiring patterns.

The scientists under discussion are those trained in the natural sciences, social sciences, and engineering. The report primarily concerns Ph.D.s in these fields although some analyses of bachelor's and master's degree recipients appear in Part 2. Individuals with professional degrees in medicine, law, etc., are not included.

Men and women will be compared in terms of employers, starting salaries, job functions, promotions, and other variables. Changes over the 1970's in male/female differences may indicate the impact of affirmative action programs and shifting social attitudes. Because of this focus, much of the discussion will be directed to employment patterns of recent Ph.D.s, for whom relative improvement would be expected to occur first.

The sources of data for the report are described in the box on the opposite page.

Primary Data Sources and Their Scope

Source	Scope of the Data
Survey of Doctorate Recipients, National Research Council	
A survey conducted biennially since 1973 that includes a sample of about 65,000 scientists and engineers who earned Ph.D.s during the period 1934-1976. The sample is carefully stratified by sex, field, and other variables and the survey responses weighted so as to estimate population figures. The questionnaire used for the 1977 survey is shown in Appendix A.	Estimates from the survey are subject to possible error due to sampling variability. Sampling errors, which provide a measure of precision or confidence, have been computed for most statistics in the report. A fuller treatment of the subject is provided in Appendix B.
Survey of Earned Doctorates, National Research Council	
A virtually 100 percent survey of individuals receiving doctorates from U.S. institutions. Through the cooperation of graduate deans, information is collected at the time of receipt of the Ph.D. on educational background and future plans.	The survey does not include persons with professional degrees in medicine or law. Information on employment plans at the time of receiving the Ph.D. is 95 percent complete.
Central Personnel Data File, Office of Personnel Management	
A computerized file of employment data on all federal personnel. By special request, a tape extract was obtained, containing 1974 and 1978 information on the population of science and engineering degree recipients employed by federal agencies. A more detailed description of the population is provided in Appendix C.	The data do not include persons employed by the various intelligence and security agencies and persons in ungraded positions. The analyses are limited to 1974 and 1978 comparisons, since 1974 was the first year that information on level and field of education was routinely collected. Most items of information reported here were 100 percent complete.

SUMMARY OF FINDINGS

WOMEN IN INDUSTRY

- A quarter of all male scientists and engineers in the Ph.D. work force but only seven percent of such women held positions in industry in 1977. This differential is partly due to the fact that relatively few of the women Ph.D.s are in engineering and physics -- fields which together account for about 40 percent of the doctorate-level jobs in industry. (page 8)

- For several fields, the percentage of women among industrial scientists was less than half their percentage in the Ph.D. work force. (page 9)

- Women represented approximately six percent of the net increase in industrial R&D personnel between 1973 and 1977. The electronics industry recorded the largest proportional increase in number of women -- 11 percent. (page 10)

- Male doctorate-holders were twice as likely as comparable women to be in managerial positions in 1977. (page 11)

- Sex differences in salaries for new Ph.D.s have been greatly reduced. Otherwise, the pay differential remains substantial: men typically earned $7,500 more than women among older Ph.D.s and $4,000 more in the mid-career group, based on 1977 salaries. For the mid-career scientists and engineers the salary differentials were noticeably larger in the 1977 than in 1973. (page 15)

- Similar proportions of men and women in industry had received their doctorates from prestigious academic departments (page 18), but in several fields the men were more likely to have engaged in postdoctoral study prior to employment. (page 20)

- The sex differences in hiring rates and salaries are most marked in the life sciences where the pool of doctoral women is relatively large. (page 22)

- The available data do not identify causes of the differences in employment, work activities, and salaries for men and women Ph.D.s in industry. (page 23)

WOMEN IN THE FEDERAL GOVERNMENT

- Between 1974 and 1978 the number of women scientists and engineers in the federal government grew from just under 8,000 to nearly 12,000 or 50 percent, while total federal employment of such personnel increased from 134,700 to 156,200 or 16 percent. (page 27)

- Women now account for one in 13 of the federally employed scientists and engineers at all degree levels and one in 20 of the Ph.D. personnel. (page 27)

- Approximately 21 percent of the women scientists and engineers were in GS 13 and above in 1978 compared with 45 percent of the men. (page 28)

- The proportion of women scientists and engineers in GS 15-18 showed an increase from 2.4 percent in 1974 to 2.9 percent in 1978. (page 28)

- In general, women scientists and engineers were promoted to a higher grade and to management positions at a faster rate than their male counterparts between 1974 and 1978. Forty percent of the women who were GS 12's in 1974 had been promoted to a higher grade by 1978 compared with 28 percent of the men. Despite these adjustments, women scientists and engineers still hold only about 500 of the 17,600 federal managerial jobs. (page 31)

- Salary differences for men and women scientists and engineers remained substantial, despite the fact that women's earnings climbed somewhat more rapidly than did men's over this period. In the mid-career group -- those age 40-44 -- the differential in pay amounted to $4,300 as of 1978. (page 34)

- Among the new accessions, women scientists were typically hired at a lower grade and a lower salary than comparable males. This was found at all degree levels and number of years since the degree was earned. (page 36)

- Sex differences in starting salaries for new Ph.D.s in government are slight, but for those six years or more past the doctorate, the differential grows to at least $2,400. (page 36)

- Sex differences in starting salaries and grade levels for recent bachelor's and master's degree holders remain large, with men earning almost 20 percent more than women. (page 37)

PART 1

DOCTORAL WOMEN SCIENTISTS AND ENGINEERS IN INDUSTRY

Federal laws prohibiting sex discrimination in employment first appeared in Title VII of the Civil Rights Act of 1964. It was not until 1971, however, that government contractors were required to develop written affirmative action plans containing goals and timetables. In 1972, Title VII was amended to cover all private employers of 15 or more persons -- regardless of whether or not they receive federal funds -- in addition to public institutions. The threat of losing government contracts due to failure to comply is a real one. To date, the Labor Department has debarred 21 firms from federal contracts for this reason.

To what extent have these pressures affected the rate of hiring and advancement of women scientists and engineers? If special efforts are being made towards more equitable employment, one would expect to find: (i) an increasing proportion of the pool of qualified women among new hires, (ii) a narrowing of salary differences, and (iii) growing numbers of women in management positions.

In this section of the report, we will examine recent trends in the employment of women doctorates in private industry -- their employers, work activities, salaries, and other characteristics. The mileposts for measuring progress will be 1973 and 1977 since these are the earliest and most recent years for which reliable longitudinal data are available.

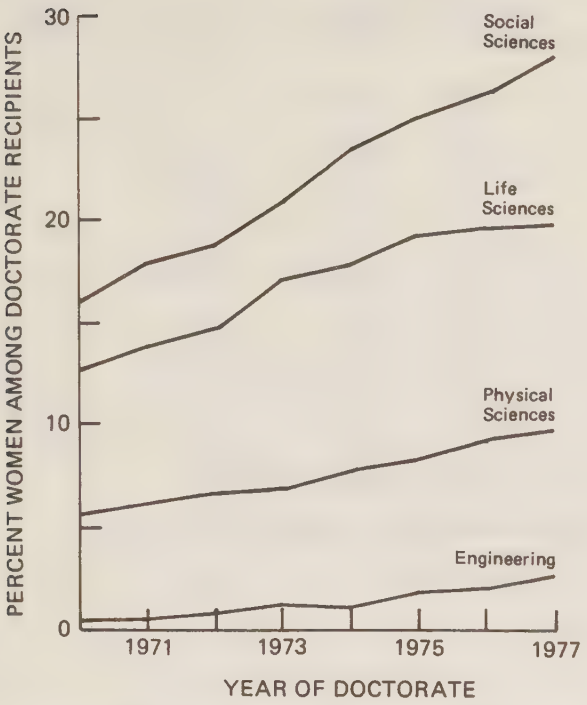
The data are derived from the National Research Council's 1973 and 1977 surveys of doctorate recipients (see box on page 3). Included are Ph.D. scientists and engineers in the labor force who earned doctorates in the period since 1934.

Business and industry employment figures shown here exclude individuals who are self-employed.

Supply of Women Ph.D.s

The proportion of women among new science and engineering Ph.D.s has risen sharply in recent years to a 1977 level of 10 percent in physical sciences, 20 percent in biosciences, and nearly 30 percent in social sciences (Figure 1.1).

FIGURE 1.1 Percent of doctoral degrees in science and engineering awarded to women, 1970-1977.



SOURCE: Survey of Earned Doctorates, National Research Council

Employment Trends

A quarter of all male scientists and engineers with the Ph.D. but only seven percent of such women held positions in industry in 1977 (Table 1.1). The pattern is similar among the most recent Ph.D. graduates, and although the proportion of women going into industry has increased since 1973, it is still under 10 percent. This differential is largely due to the fact that relatively few of the women Ph.D.s are in engineering and physics -- fields which together account for about 40 percent of the doctorate-level jobs in industry.

TABLE 1.1 Doctoral scientists and engineers by employment sector and sex

	1973 Employment		1977 Employment	
	Men	Women	Men	Women
All Ph.D.s				
Number	185,800	14,700	236,800	24,200
% Business/industry	24	5	26	7
Academe	57	72	55	68
U.S. government	9	6	8	5
Other employers	10	17	11	20
New Ph.D.s*				
Number	26,400	3,000	22,500	4,400
% Business/industry	22	5	25	9
Academe	56	73	52	64
U.S. government	9	3	8	3
Other employers	13	19	15	24

*Earned doctorate 1-2 years prior to employment survey.

SOURCE: Survey of Doctorate Recipients, National Research Council

Utilization by Field

All companies that have federal contracts are required to submit annual reports to the Department of Labor on their affirmative action programs. Such reports as a rule include the percent of women employees compared with their proportion in the available pool. An industry-wide analysis of this sort is shown in Table 1.2.

Among doctorate-level personnel, the rate of industrial employment of women scientists is less than half their rate in the Ph.D. work force. The discrepancy between percent of women employed in industry and the percent availability is largest in the life sciences, with the greatest discrepancy occurring in medical sciences. It is interesting to note, however, that in physics and engineering, which are major feeder fields for industry, the percent women matches their representation in the doctoral pool.

TABLE 1.2 Percent doctoral women employed in industry and percent available, 1977

Field	Total Ph.D.s in industry	No. women industry	% Women industry	% Women in Ph.D. labor force
All fields	61,500	1,700	3%	10%
Engineering, math & physical sciences	49,100	900	2	4
Mathematics	1,100	50	4	7
Computer sciences	2,900	100	3	7
Physics	3,900	80	2	2
Chemistry	17,100	500	3	6
Earth sciences	2,800	70	2	4
Engineering	21,300	100	1	1
Life sciences	8,500	400	5	13
Agricultural sciences	2,600	20	1	2
Medical sciences	2,400	100	4	13
Biological sciences	3,500	280	8	16
Behavioral & social sciences	3,900	400	9	18
Psychology	1,800	200	11	23
Social sciences	2,100	200	8	14

SOURCE: Survey of Doctorate Recipients, National Research Council

Profile by Industry

Overall, industrial R&D personnel who hold science and engineering doctorates increased by an estimated 8,900 in four years from 37,200 in 1973 to 46,100 in 1979. Women represented six percent of the net increase. Of the manufacturing companies, the electrical equipment industry recorded the largest proportion of women among net R&D growth -- 11 percent -- although it sustained one of the lowest rates of growth of R&D personnel over this period (Table 1.3).[1]

The most striking under-representation of women scientists and engineers in R&D appears in the fastest-growing industrial sector, "other nonmanufacturing" companies, which grew at an annual rate of 14 percent in number of Ph.D.s employed in R&D, but in which only 3.6 percent of the additional personnel were women. This sector includes companies engaged in such activities as agriculture, mining, finance, and wholesale and retail trade -- fields in which few women scientists are found (with the possible exception of retail trade).

[1]The "electrical equipment" industry includes companies whose gross revenues are chiefly from electrical and communications products, such as AT&T, General Electric, and Westinghouse, etc. Industry groups are defined by the Standard Industrial Classification of the Office of Management and Budget.

TABLE 1.3 Four-year growth in R & D personnel[1] who hold science and engineering doctorates by industry group, including increase in numbers of women

Industry Group[2]	Doctoral R & D Personnel 1973	1977	Average Annual Growth (1973-77)	4-Year Growth Total	No. of Women	Women as % of Increase
Total employed	37,209	46,088	5.5%	8,879	531	6.0%
Classifiable companies	34,974	43,410	5.6	8,436	525	6.2
Manufacturing	32,253	39,603	5.3	7,350	461	6.3
Chemicals	7,751	9,353	4.8	1,602	98	6.1
Electrical equipment	6,085	6,858	3.0	773	86	11.1
Pharmaceuticals	3,206	4,297	7.6	1,091	77	7.1
Petroleum and refining	3,343	3,900	3.9	557	35	6.3
Instruments	2,259	3,118	8.4	859	40	4.7
Other Manufacturing	9,609	12,077	5.9	2,468	125	5.1
Services	1,682	2,066	5.3	384	39	10.2
Other non-manufacturing	1,039	1,741	13.8	702	25	3.6
Non-classifiable companies	2,235	2,678	5.0	443	6	1.3

[1]Includes individuals whose primary work activity is management or performance of research and development.

[2]Standard Industrial Classification.

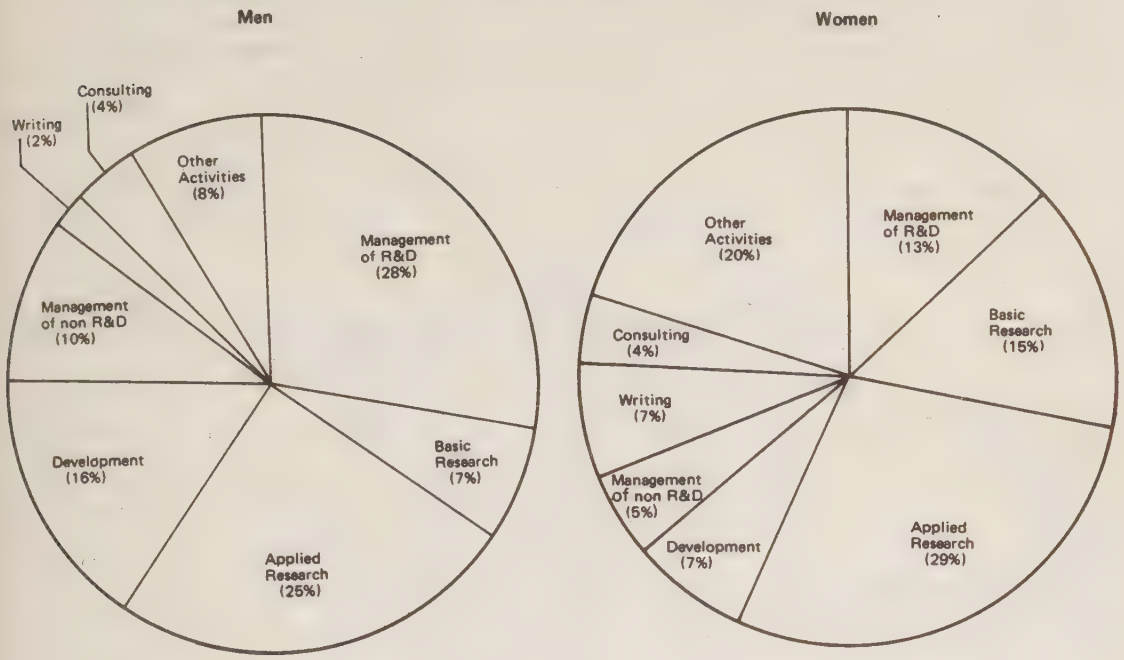
SOURCE: Survey of Doctorate Recipients, National Research Council

Women Managers

Before examining salary differentials between men and women, it is important to consider possible differences in types of positions held. The available data on doctoral scientists and engineers in industry do not indicate the level or kinds of responsibility involved or experience required. Nor do many positions in industry lend themselves to classific tion into well-defined categories such as occur in academic and governmen jobs. The information at hand allows us to categorize jobs by industry group, primary work activity, and salary.

Some major differences in work activities for men and women are evident from Figure 1.2. Men are twice as likely as their female colleagues to be in managerial positions -- a difference which we will discuss later with reference to their comparative salaries. Within R&D activities, basic research employs relatively more women scientists and development relatively more men.

FIGURE 1.2 Primary work activities of doctoral scientists and engineers in industry, 1977.



SOURCE: Survey of Doctorate Recipients, National Research Council

The 18 percent of women scientists and engineers in management (R&D and other) in 1977 is actually lower than the comparable statistic of 20 percent for 1973, although the difference is not statistically significant. For both men and women, the proportion who were managers dropped between 1973 and 1977, but the 2-to-1 ratio remained constant (Table 1.4).

TABLE 1.4 Percent of doctoral scientists and engineers in industry whose primary work activity is management, 1973 and 1977

	Men	Women
% Managers		
1973	40.3	20.0
1977	37.2	18.1

SOURCE: Survey of Doctorate Recipients, National Research Council

Examining work activities by field (Table 1.5), we find that the principal job functions for men and women are most dissimilar in the life sciences. About 40 percent of the male scientists, but only 15 percent of the females, are engaged in management of R&D.[2] In both the life and social sciences -- fields with relatively large proportions of women Ph.D.s -- men are also about twice as likely to be employed as consultants.

TABLE 1.5 Primary work activities of doctoral scientists and engineers in industry by field and sex, 1977

Primary work activity	All fields		Engineering, math., and physical sciences		Life sciences		Behavioral and social sciences	
	Men	Women	Men	Women	Men	Women	Men	Women
Total	59,844	1,692	48,198	910	8,126	413	3,520	369
Total reporting activity	59,038	1,657	47,705	893	7,954	411	3,379	353
Management of R&D	27.7%	13.5%*	26.6%	14.4%*	39.3%	14.8%*	16.0%	9.3%
Basic research	6.7	14.8 *	6.8	14.9 *	7.1	18.2 *	3.9	10.5*
Applied research	25.5	29.3	26.6	36.2 *	18.0	24.1	28.3	17.8
Development	16.3	7.0 *	19.0	11.4 *	5.9	3.4	2.2	0.0
Management, other	9.5	4.6 *	9.2	4.5 *	9.4	4.4	14.4	5.4*
Consulting	4.2	3.9 *	3.4	3.0	5.4	2.2	12.1	7.9
Sales/marketing	2.6	1.9	2.3	0.6 *	4.1	2.2	3.2	4.8
Prof. services to individuals	1.5	6.0 *	0.7	1.6 *	2.8	7.3 *	9.2	15.6
Technical writing	1.5	7.1 *	1.0	4.3 *	2.7	10.9 *	4.5	9.9
Production/inspection	2.0	4.0 *	2.0	2.8	2.7	6.6 *	0.4	4.0*
Other	2.5	7.9 *	2.3	6.4 *	2.6	5.8	5.7	14.7*

*Sex difference is statistically significant at the .05 level.

SOURCE: Survey of Doctorate Recipients, National Research Council.

Most marked is the difference between men and women primarily engaged in technical writing and in "other" nonclassified work activities. About 15 percent of all industrially employed women scientists and engineers are in these two categories, and they are more than three times as likely as men to hold such positions. The undefined work category presumably includes such functions as staff work and other internal support services, e.g. libraries, which are often not viewed as central to a company's business.

[2]The estimated percents in management of R&D and their corresponding sampling errors are: men, 39.3 $\pm$ 1.5 percent; women, 14.8 $\pm$ 3.4 percent.

What about promotions to management positions between 1973 and 1977? Is there evidence that women scientists and engineers moved into managerial slots at a greater rate than did male Ph.D. personnel over this period? Table 1.6 shows that about one in six of the women on R&D staffs (non-management) in 1973 was promoted to management positions by 1977 as compared with slightly more than one in five of their male counterparts. However, the difference is not statistically significant. In addition, it should be noted that the data are not segregated by age, which may be a factor in rate of promotion.

TABLE 1.6 Promotions of doctoral R&D personnel to management of R&D, 1973 to 1977, by sex

	1973	1977	
	Number on R&D staff (non-management)	Estimated % in management of R&D[a]	
Men	21,636	20.4	(±1.0)
Women	412	17.6	(±3.7)

[a]Based on those responding to both the 1973 and 1977 surveys.

NOTE: Estimated sampling errors are given in parentheses.

SOURCE: Survey of Doctorate Recipients, National Research Council

Salaries[3]

Median industry salaries for men and women scientists and engineers differed by nearly 20 percent as of 1977. Undoubtedly, some part of the observed salary differential is attributable to the relatively higher numbers of women among recent Ph.D.s.

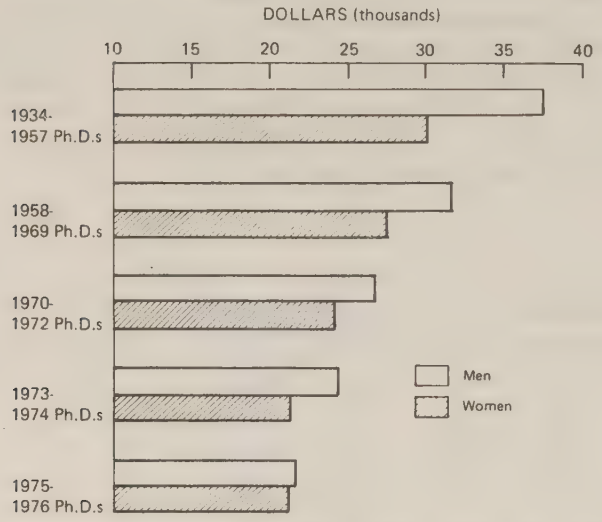
For this reason, salaries will be analyzed separately for the older Ph.D.s -- those who earned degrees in the period 1934-1957; the mid-career group, 1958-1969 Ph.D.s; and three groups of recent doctorates -- those who earned degrees in 1970-1972, 1973-1974, and 1975-1976.[4] We will also examine salary differences when controlled by number of full-time equivalent years of experience.

[3]Annual salaries were reported for February 1973 and February 1977. About 95 percent of the survey respondents provided salary information. Medians were computed for full-time employed persons only. Self-employed individuals are excluded.

[4]It is recognized that these groupings only partially control for salary differences due to cohort. However, because of the small numbers of women in industry, a finer break-out by year of doctorate would not afford reliable estimates of median salaries.

60-781 O - 80 - 7

FIGURE 1.3 Median salaries of doctoral scientists and engineers in industry by cohort and sex, 1977.



As shown in Figure 1.3, the pay differential for men and women has been greatly reduced for the most recent Ph.D.s, based on 1977 data. Otherwise, the salary disadvantage for women scientists and engineers in industry remains substantial. Men typically earned $7,500 more than women among older Ph.D.s and $4,000 more in the mid-career group. For mid-career scientists and engineers, the salary gap was markedly wider in 1977 than in 1973 (Table 1.7).

TABLE 1.7 Median annual salaries of doctoral scientists and engineers in industry* by field, cohort and sex, 1973 and 1977

		1934 - 1957 Ph.D.s			1958 - 1969 Ph. D.s			1970 - 1972 Ph.D.s		
		Men	Women	Diff.	Men	Women	Diff.	Men	Women	Diff.
All fields	1973	$28,100	$22,300	20.6%	$22,800	$20,500	10.1%	$18,700	$16,300	12.8%
	1977	37,700	30,000	20.4	31,400	27,500	12.4	26,800	24,000	10.4
Engineering, math., physical sciences	1973	27,700	22,100	20.2	22,700	20,400	10.1	18,700	16,400	12.3
	1977	37,400	*	—	31,300	27,200	13.1	26,800	23,500	12.3
Life sciences	1973	28,900	*	—	23,100	19,700	14.7	17,700	14,800	16.4
	1977	37,800	*	--	32,000	26,900	15.9	25,600	22,300	12.9
Behavioral & social sciences	1973	*	*	--	27,700	*	--	20,200	17,500	13.4
	1977	*	*	--	*	*	--	29,800	30,400	+ 2.0

*Data unreliable; estimated sampling errors are greater than ± $2,000.

NOTE: Only those full-time employed are included.

SOURCE: Survey of Doctorate Recipients, National Research Council

In all fields, the salary patterns demonstrate a growing differential with length of experience (Table 1.8). Among industrially employed physical scientists and engineers with 0-2 years experience, women earned about $700 or three percent less than their male colleagues. However, for those with the full-time equivalent of 15 years experience or more, the differential in pay increased to nearly 20 percent or a dollar difference of about $6,000. The salary gap is widest for life scientists. This may stem partly from the considerable under-representation of women managers in the life sciences, as noted on page 12. Due to the sex differences in work activities in all fields, not only the life sciences, we will next compare earnings within primary job functions, and examine any remaining discrepancies.

TABLE 1.8 Median salaries of doctoral scientists and engineers in industry by field, full-time equivalent years of experience, and sex, 1977

Field and no. of years experience	Men	Women	Diff.
All fields+			
2 years or less	$21,000	$19,500	7.1%
3-5 years	23,000	20,900	9.1
6-9 years	26,800	25,400	5.2
10-14 years	30,300	28,200	6.9
15-19 years	33,100	27,200	17.8
20-24 years	35,400	28,400	19.8
25 years or more	37,600	*	--
Engineering, math., and physical sciences			
2 years or less	$21,200	$20,500	3.3%
3-5 years	23,000	21,600	6.1
6-9 years	26,900	24,600	8.6
10-14 years	30,300	25,700	15.2
15-19 years	32,700	26,800	18.0
20-24 years	35,000	28,300	19.1
25 years more more	37,500	30,400	18.9
Life sciences			
2 years or less	$19,300	*	--
3-5 years	22,900	$20,500	10.5%
6-9 years	25,700	23,100	10.1
10-14 years	30,300	*	--
15-19 years	35,800	*	--
20-24 years	36,200	*	--
25 years or more	37,600	28,200	25.0

*Data unreliable; estimated sampling errors are ± $2,000 or greater.

+The behavioral and social sciences are included in "all fields" but are not shown separately due to relatively large sampling errors.

NOTE: Only those full-time employed are included.

SOURCE: Survey of Doctorate Recipients, National Research Council

FIGURE 1.4 Median salaries of R&D personnel by primary work activity and years of experience, 1977.

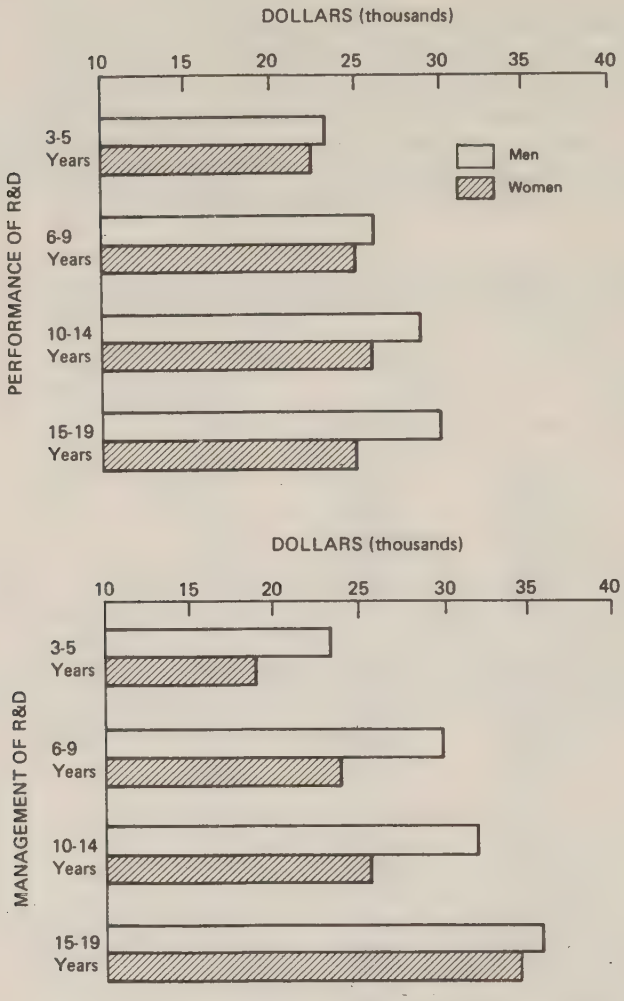


Figure 1.4 and Table 1.9 show median salaries paid to R&D personnel in the engineering, mathematical, and physical sciences according to primary work activity, years of experience, and sex. In this analysis, the life sciences and behavioral and social sciences are not shown separately due to the small number of women on which the salary estimates would be based. Women engaged in performance of R&D (i.e., basic research, applied research, and development) with 3-5 years experience typically earned $1,000 less than their male colleagues, while for those with 15-19 years of experience, the differential increased to $5,000. Among women managers of R&D, the salary patterns were quite different, with a consistently large (20 percent) gap in pay, except for those with 15 or more years experience.

TABLE 1.9 Median salaries of R&D personnel in engineering, mathematics, and physical sciences, 1977

	Men	Women	Diff.
Primary work activity:			
Performance of R&D			
3-5 years experience	$23,200	$22,400	3.4%
6-9 years	26,000	25,200	3.1
10-14 years	28,900	26,300	9.0
15-19 years	30,000	25,100	16.3
Management of R&D			
3-5 years experience	$23,400	$18,800	19.7
6-9 years	30,000	23,900	20.3
10-14 years	32,000	25,800	19.4
15-19 years	36,100	34,400	4.7

*Data unreliable; estimated sampling errors are greater than ± $2,000.

NOTE: Only those full-time employed are included.

SOURCE: Survey of Doctorate Recipients, National Research Council

Educational background of women in industry

Across all fields, similar proportions of men and women in industry had earned doctorates from prestigious departments. In both the EMP fields (engineering, mathematics, and physical sciences) and the life sciences, the women are significantly more likely to have received their Ph.D.s from highly rated departments while the reverse holds in the behavioral and social sciences (Table 1.10).

TABLE 1.10 Recent science and engineering Ph.D.s employed in industry in 1977

	% from prestigious doctoral departments[1]			
	1970 - 1976 Ph.D.s		1975-1976 Ph.D.s only	
	Men	Women	Men	Women
All fields	41%	41%	40%	38%
Engineering, mathematics and physical sciences	43	49	44	55
Life sciences	35	41	28	34
Behavioral and social sciences	29	24	24	11

[1] Based on Roose-Andersen rating of doctoral departments, published in Kenneth D. Roose and Charles J. Andersen, *A Rating of Graduate Programs*, American Council on Education, Washington, D.C. 1970.

SOURCE: Survey of Doctorate Recipients, National Research Council.

Financial support during graduate school

A number of companies provide financial aid to graduate students in science and engineering departments. The extent to which women students receive such support is relevant in that it may create early ties with industry and lead to subsequent employment.

Of the scientists and engineers awarded doctorates in 1976, about 800, including 80 women, had received support at some time during graduate school from company educational funds. It should be stressed that this represents less than one twentieth of all doctoral science and engineering students, so that such support is only a small contribution to financial aid. The majority of the recipients were in the physical sciences and engineering. Table 1.11 shows that in all departments but the social sciences, male and female students are about equally likely to be supported by industry funds.

TABLE 1.11 Recent science and engineering Ph.D.s who received support from company educational funds during graduate school

New Ph.D.s who have received support		Physical sciences		Engineering		Life sciences		Social sciences	
		Men	Women	Men	Women	Men	Women	Men	Women
1972	No.	310	17	379	3	77	10	90	12
	%	6.2	4.8	11.4	14.3	1.9	1.5	2.1	1.2
1973	No.	271	12	377	2	80	10	97	15
	%	5.8	3.3	11.9	4.4	2.0	1.2	2.2	1.3
1974	No.	235	16	341	4	75	11	90	20
	%	5.5	4.5	11.7	12.5	2.0	1.4	2.1	1.5
1975	No.	256	19	315	3	108	20	112	15
	%	6.1	5.0	11.3	6.0	2.8	2.2	2.5	1.0
1976	No.	283	26	307	6	107	28	97	18
	%	7.3	6.6	11.7	11.8	2.8	3.0	2.1	1.1

SOURCE: Commission on Human Resources, National Research Council, *Summary Report, Doctorate Recipients from United States Universities*, 1972-1976 reports in the series.

Quality of Men and Women Ph.D.s

A previous report by this Committee sought to assess the relative quality of men and women scientists at receipt of the Ph.D. Given that no objective measures of research potential exist, the Committee concluded that based on academic records, elapsed time from BA to Ph.D., and ranking of graudate departments attended, women scientists and engineers on the average are at least equal to men in quality at receipt of the

doctorate.[5]

Postdoctoral training prior to employment

Between 1970 and 1976 an increasing proportion of Ph.D.s in the physical and life sciences elected postdoctoral study following graduation.[6] This presumably reflects the fact that fewer traditional jobs have been available in recent years. When asked whether they had held a postdoctoral appointment prior to employment in industry about 40 percent of the men in selected fields reported "yes". Postdoctoral training was far less prevalent among industrially employed women, except in the biosciences (Table 1.12).

TABLE 1.12 Recent science and engineering Ph.D.s employed in industry in 1977 and percent who had received postdoctoral training, by field and sex

	Doctoral scientists in industry 1977			
	Men		Women	
Field	1970-1976 Ph.D.s	% Who have held postdoc.	1970-1976 Ph.D.s	% Who have held postdoc.
Physics	1,442	40% (±4%)	39	13% (±7%)
Chemistry	4,858	38 (±2%)	283	30 (±4%)
Medical sciences	797	41 (±5%)	61	23 (±11%)
Biological sciences	1,386	37 (±4%)	159	45 (±8%)

NOTE: Estimated sampling errors are shown in parentheses.

SOURCE: Survey of Doctorate Recipients, National Research Council

[5]Committee on the Education and Employment of Women in Science and Engineering, Commission on Human Resources, National Research Council, *Climbing the Academic Ladder: Doctoral Women Scientists in Academe* (Washington, D.C.: National Academy of Sciences, 1979).

[6]Commission on Human Resources, National Research Council, *Summary Report, Doctorate Recipients from United States Universities*, 1970-1976 reports in the series (Washington, D.C.: National Academy of Sciences).

Industry's views of the desirability of postdoctoral education tend to be mixed. Some companies regard the additional academic training as a disadvantage in that it motivates the young Ph.D. away from applied research and may further create an aloofness that is not consonant with larger team-oriented research. Other companies prefer the greater specialization gained by the postdoctoral, particularly in certain rapidly-changing high technology fields. In the past, only a minority of corporations have actively recruited from among postdoctoral students for new personnel.[7] The fact that in recent years a growing proportion of young Ph.D.s in industry have taken postdoctorals may indicate that companies are now increasing their recruiting at this level.

In any case it is not clear that the generally lower incidence of postdoctoral training among women than men in industry has significant implications to their employers.

Industry hiring

Among recent graduates of science and engineering departments, women have been less likely than men to seek positions in industry. The reasons for this are not known, but will be explored by this Committee in a more intensive study of industrial recruitment. Data are available, however, on the number of new Ph.D.s who were looking for industrial employment, and how women fare in receiving job offers.

TABLE 1.13 Number of 1970-1976 doctorate recipients seeking positions in industry and percent who had signed contracts at the time of receiving the Ph.D., by field, cohort and sex (estimated).

	Men			Women		
	Total planning employment in industry	Have definite job	Still seeking	Total planning employment in industry	Have definite job	Still seeking
Total	16,551	79%	21%	619	72%	28%
Field						
Engineering, mathematics and physical sciences	13,691	79	21	300	74	26
Life sciences	1,794	77	23	98	52	48
Behavioral & social sci.	1,066	81	19	221	80	20
Year of Doctorate						
1970-1972	7,305	81	19	154	68	32
1973-1974	5,145	76	24	199	84	16
1975-1976	4,101	80	20	266	66	34

SOURCE: Survey of Doctorate Recipients, National Research Council

[7]National Research Council, *The Invisible University: Postdoctoral Education in the United States* (Washington, D.C.: National Academy of Sciences, 1969), pp. 197-204.

One measure of their success is whether they have a definite job at the time of receiving the doctorate. Table 1.13 shows that 79 percent of the men had definite jobs at the time of Ph.D. compared with 72 percent of the women. It should be underscored that the figures are based on graduates who reported they were seeking positions in industry -- men or women who were looking for other kinds of positions or who expected to be unemployed are not included. A greater success in receiving early offers is particularly evident for men in the life science fields. About three-fourths of the male Ph.D.s but only one-half of their female counterparts had definite commitments.

If we examine selected cohorts, there appears to have been a relative improvement in employment prospects for women who earned degrees in 1973 and 1974, followed by a sharp decline for the 1975-1976 women graduates.

Summary and Discussion

Despite a rise in the proportion of recent women Ph.D.s employed in industry between 1973 and 1977, women are still less than three percent of all doctoral scientists and engineers in industry. In several fields, their rate of industrial employment is less than half that of their availability in the doctoral work force. The average increase in women's R&D employment -- six percent -- matched the average industrial rate of growth in R&D personnel during this period, greatly exceeded it in the electrical equipment industry, and fell far short of the growth in "other nonmanufacturing" industries.

The primary work functions of men and women differ significantly. Women are much more likely than men to be engaged in research and in "other" activities, and men are twice as likely as women to be managers.

Salaries of female scientists and engineers are lower than those of males, by percentages ranging from about three to almost 25 percent in various fields and levels of experience. The salary differences remain when earnings are controlled by primary job function, and are larger for managers than for research personnel. These salary differentials increased from 1973 to 1977, and remain large for all but the most recent hires.

The evidence cited in this report suggests that despite the similarity of women and men doctoral scientists in terms of educational background and quality, women are less readily recruited and hired for industrial positions.

There are thus a number of important indications that despite affirmative action requirements which now go back nearly ten years, male scientists are hired earlier and paid more. The differences become most marked in the life sciences, where the pool of doctoral women is relatively large. This is in contrast to the situation in academe, where the fields

of mathematics and chemistry were found to be least receptive to advancement of women, as documented in an earlier report of this Committee.

With the information available at present, we can do little more than speculate about the reasons for these considerable differences. Does the small proportion of women doctorates who seek industrial employment reflect in some measure a perception that such positions will not be congenial or rewarding? We know very little about the specific factors involved in such employment choices and decisions for both men and women. For example, are women scientists less attracted to year-round employment due to family responsibilities? Does work location or individual mobility play a larger role here than in academic employment? Are women scientists in industry more likely than those in academe to be married, and thus to be especially constrained in their choices? We also have no information about the extent to which companies maintain explicit or implicit anti-nepotism policies (which are known to have a disproportionate impact on women), or whether they recruit through open advertising in all cases. Further, the relatively isolated location of some major research laboratories may make them undesirable for two-career couples, who are known to prefer the multiple choices available in metropolitan areas. These issues underscore the need for information on the marital status of women scientists in industry.

Given that there are considerable differences among industries in the degree of utilization of women scientists and engineers, there may also be some companies which are markedly more successful than others within the same industry in recruiting, hiring, and promoting women. Undoubtedly, in some cases such successes result from particular affirmative action efforts. It is also possible that some companies have developed a tradition of more equitable employment without such stimulus.

The sex differences in hiring rates and salaries which persist suggest that affirmative action mandates are not enforced at professional levels in industry, but a firm conclusion of this sort must await a more detailed study. The fact that women are such a small fraction of the doctoral work force in industry implies that they are widely scattered but does not preclude the possibility that they are concentrated in a few companies in certain specialized work functions which are typically lower-ranking and lower-salaried. At any rate, the available data do not indicate the reasons for the differences we find in employment, work activities, and salaries for men and women Ph.D.s in industry.

PART 2

WOMEN SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT

The federal government has a long history of laws and executive orders prohibiting employment discrimination. Executive Order 11478, issued in 1969, required each agency and department to maintain an affirmative program of equal employment opportunity. With the passage of the Equal Employment Opportunity Act of 1972, enforcement provisions were strengthened.

A number of internal government structures have been created to deal with affirmative action programs, recruitment policies, and bias complaints. The Federal Women's Program (FWP) was established in 1967 under the provisions of Executive Order 11375. FWP managers, located throughout the federal agencies and departments, are responsible for identifying barriers within their organization and working with agency officials on corrective strategies. Agency-wide oversight of EEO policies is carried out by the Office of Personnel Management. (See box on next page.)

Recent sex discrimination cases brought against federal agencies have focused attention on possible bias in promotions. In a July 1978 consent agreement, the Justice Department acknowledged that there had been widespread discrimination against women professionals at the Department of Energy. The suit was brought by a manpower analyst and some 255 other women in scientific and other professional positions. More recently, a discrimination suit was won by a woman mathematician at the National Institutes of Health, granting her a retroactive pay raise. In the DOE case, the government reportedly agreed that there was an $8 million salary discrepancy for men and women in the same types of positions.[1]

What is the situation for women scientists and engineers in other departments and agencies? Of particular interest is whether women are being hired, paid, and promoted at the same rate as men with similar training.

In this section we will examine employment data on men and women scientists in the federal government for 1974 and 1978. The data were obtained from the Office of Personnel Management's computerized files and include the entire population of interest rather than a sample. (See box on page 3 for a description of the data base and its scope.) Included in the following analyses are persons who were trained in science and

[1] *Washington Post*, 15 July 1978, p. 5.

In February 1979 Alan K. Campbell, Director of the Office of Personnel Management, submitted a statement to the Senate Committee on Human Resources for hearings on "The Coming Decade: American Women and Human Resources Policies and Programs". Following is an excerpt of his statement on Federal employment of women:

With regard to Federal employment, women comprised 30.7 percent of the total Federal civilian work force in 1977. They comprised 77.1 percent of employees in grades 1 through 4, but they comprised only 3.4 percent of employees in grades 16 through 18. Despite the large number of women in the Federal Career Service, few of them have reached the executive levels.

Of particular concern today is the scanty representation of women in grades 13 through 15 since these comprise the "feeder group," the ranks which produce tomorrow's executives. Since Federal managers tend to fill top jobs almost exclusively from within, the paucity of women in the "feeder grades" makes it extremely unlikely that the supergrade situation for women will improve markedly so long as we hold to present staffing habits.

Hard data such as these explain why the Federal Women's Program (FWP) was established in 1967 -- "to enhance employment and advancement opportunities for women in Government." The purpose of the FWP is to assist women in applying for, obtaining, and advancing in Federal employment. The Federal Women's Program Office, which is part of the Affirmative Employment Programs Office of the Office of Personnel Management, provides Government-wide leadership and guidance to the Federal Women's Program.

Each Federal agency and department is required to have an FWP Manager, and today there are over 50 full-time and 10,000 part-time FWP Managers around the world. Each FWP Manager works to identify special employment problems for women within the Manager's organization. Then the FWP Manager works with top organization management to develop and implement strategies for eliminating barriers to full employment opportunities for women.

Over the past 10 years, we have certainly seen some progress. Although there still are far too few women in the "feeder" grades and in the supergrades, there has been a significant increase in the number of women in professional and technical jobs in grades 7 through 11. Federal employment for women has been enhanced through repeal of restrictions on women bearing firearms as Federal employees, repeal of height restrictions for most Federal jobs, changes in leave provisions which allow advancing up to 30 days of sick leave for maternity, and increased use of part-time employment and flexible working schedules. But we still have a long way to go.

The Civil Service Reform Act of 1978 includes provisions such as merit pay for supervisors and managers, recruitment for women and minorities where they are underrepresented, and new performance appraisal systems -- provisions with tremendous potential impact on Federal women. The Office of Personnel Management plans to delegate much of the responsibility for implementing these provisions to agencies. Therefore, the primary focus for agency FWP Managers in the coming years will be to help forge these implementing regulations and to assure that agency personnel policies and practices are both creative and equitable with regard to employment for women.

engineering fields, Bachelor's degree and above.[2] The population is further restricted to those employed in professional scientific or engineering positions or in certain administrative categories.[3] Both competitive and excepted personnel are included. However, the analyses are limited to graded positions.

Utilization by field

Between 1974 and 1978 the number of women scientists and engineers in the federal service grew by 50 percent from just under 8,000 to nearly 12,000. Total employment of scientists and engineers increased 16 percent over the same period.

Women now account for one in thirteen of the federally employed scientists and engineers. Their representation varies considerably by field, however, as shown in Table 2.1.

TABLE 2.1 Number and percent women among scientists and engineers in the federal government by field, 1978

Field*	All degree levels No. Women	% Women
All science/engr fields	11,713	7.5
Mathematicians/statisticians	1,963	18.6
Computer specialists	229	12.1
Physicists	206	2.8
Chemists	979	13.5
Other physical scientists	550	6.1
Engineers	617	0.9
Agricultural scientists	551	2.6
Bioscientists	1,929	17.3
Social scientists*	4,648	23.3

*Field of highest degree. Specialties included in each of the field categories are shown in Appendix C.

[2]Purposely excluded are degree recipients in the health and medical professional fields. The academic fields of science and engineering that were included are listed in Appendix C, Table C-1.

[3]See Appendix C, Table C-2, for definitions of the selected occupational series and titles.

At the Ph.D. level, the government employed about 800 women scientists and engineers in 1978, compared with fewer than 500 four years earlier. The proportion of women among doctorate-level personnel -- in the federal government and nationwide -- is shown in Table 2.2. Women appear to be under-represented in nearly all fields, markedly so in biosciences.

TABLE 2.2 Percent women among doctoral scientists and engineers in the federal government, 1978, and percent in the total labor force

Field of doctorate*	Ph.D.s in federal government+			Total labor force**
	No. men	No. women	% women	% women
All science/engr. fields	13,953	761	5.2	9.7
Mathematicians/statisticians	511	33	6.1	6.9
Computer scientists	50	1	2.0	6.8
Physicists	1,491	32	2.1	2.5
Chemists	1,593	95	5.6	6.1
Other physical scientists	1,878	62	3.2	3.6
Engineers	2,291	23	1.0	0.5
Agricultural scientists	1,232	15	1.2	2.0
Bioscientists	3,011	251	7.7	15.6
Social scientists	1,842	245	11.7	18.0

*Specialties included in each of the field categories are shown in Appendix C.

+Central Personnel Data File, U.S. Office of Personnel Management.

** Survey of Doctorate Recipients, National Research Council, 1977

Grade distribution

The categories of federal employment are defined by Civil Service grade levels. Comparing the grade distribution of men and women over time is a measure of their relative status and rates of advancement.

Table 2.3 shows that in 1978, 45.2 percent of the men were GS 13's and above compared with only 21.3 percent of the women scientists. The gap is only slightly less than that in 1974, when the comparable data were 45.4 and 20.6 percent, respectively. However, there is evidence of an increased proportion of women in grades 15-18 -- up from 2.4 to 2.9 percent. This increase in the upper levels, while modest, is important due to the high visibility of such positions.

For women Ph.D. scientists and engineers in particular, the progress

TABLE 2.3 Percent grade distribution of scientists and engineers in the federal government by sex, 1974 and 1978

	(All degree levels)			
	1974		1978	
Grade	Men	Women	Men	Women
Below 11	13.8	41.4	12.8*	39.4
11	17.5	19.7	16.6	19.1
12	23.2	18.4	25.4	20.2
13	23.9	13.2	23.6	12.9
14	12.8	5.0	13.0	5.5
15	7.3	2.1	7.4	2.4
16-18	1.4	0.3	1.2	0.5

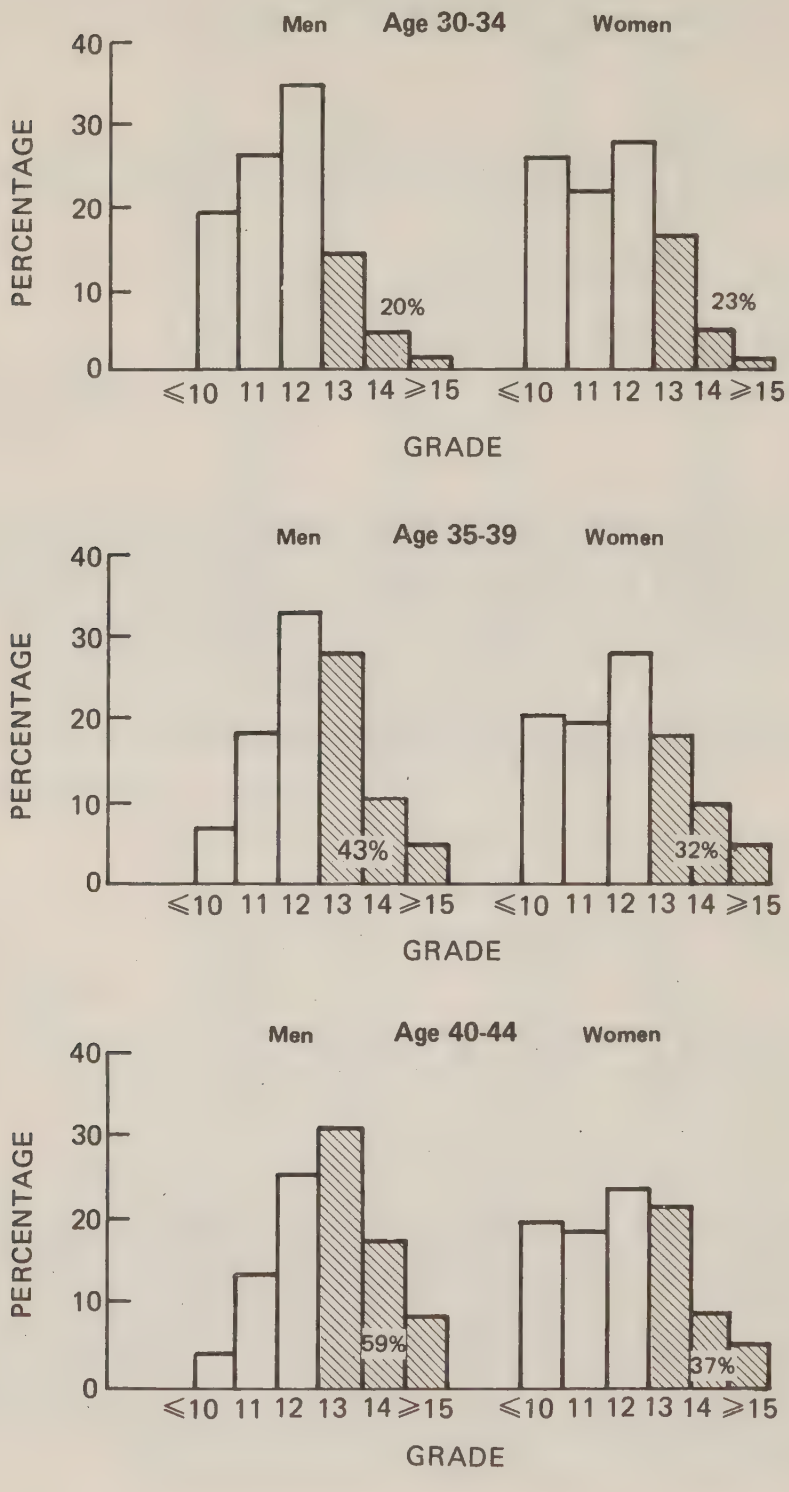
is less obvious. While the proportion of men in grades 15-18 remained the same over this period -- about 23 percent -- the comparable figure for women Ph.D.s dropped from approximately 12 to 10 percent (Table 2.4). This may be partly due to an influx of women hired at the GS 11 and 12 levels which will be discussed later in this report (See page 35).

TABLE 2.4 Percent grade distribution of Ph.D. scientists and engineers in the federal government by sex, 1974 and 1978

	(Ph.D.s only)			
	1974		1978	
Grade	Men	Women	Men	Women
≤11	5.4	13.0	6.3	18.2
12	16.4	21.8	16.4	26.0
13	31.0	33.4	28.9	29.3
14	23.5	20.0	25.0	16.4
15	18.4	10.0	19.3	8.4
16-18	5.1	1.9	4.2	1.7

Since women comprise relatively more of the recent hires, it is worthwhile to control by age in comparing their grade distribution with that for men. Except for the younger age groups, women scientists have a grade profile very different from men in the same five-year cohort (Figure 2.1). And while the grade distribution for men shifts upward significantly in the late thirties and the forties, the profile for women over the same age span does not change materially. In all age groups, well over half of the women scientists have not advanced past GS 12, whereas by the early forties nearly 60 percent of their male colleagues have.

FIGURE 2.1 Percent grade distribution of scientists and engineers in the Federal Government by age and sex, 1978.



Senior-level positions

In Table 2.5, we compare the proportions of men and women scientists and engineers in "senior-level" positions (GS 13-15) and in the "super-grades" (GS 16-18) by field. In most fields of science and engineering, men are two to three times as likely to be found in grades 13-15. Even in the social sciences where women fare best relative to their male counterparts, only one-fourth of the women are in senior-level positions compared with nearly one-half of the men.

TABLE 2.5 Percent of scientists and engineers in grades 13-18 by field and sex, 1978

	GS 13-15		GS 16-18	
Field*	Men	Women	Men	Women
Mathematicians/statisticians	47%	24%	1.0%	0.4%
Physical scientists	51	18	1.8	0.4
Engineers	49	18	0.9	0.2
Agricultural scientists	20	6	0.7	0.0
Bioscientists	38	14	1.2	0.2
Social scientists	46	25	2.9	0.8

*Field of highest degree. Specialties included in each of the field categories are shown in Appendix C.

Promotions between 1974 and 1978

In order to better assess the changes in recent years, it will be necessary to examine separately the statistics for (i) scientists and engineers who were employed in the federal government in both 1974 and 1978, and (ii) those hired since 1974.

For women scientists and engineers who were already in the federal service in 1974, an important measure of progress is their rate of promotion. As indicated in Table 2.6, women were promoted at a faster rate than their male counterparts between 1974 and 1978. Forty percent of the women scientists and engineers who were at GS 12 in 1974 had been promoted to a higher grade by 1978 compared with only 28 percent of the men. It should be pointed out, however, that in 1974 there were already some 45,000 men scientists and engineers in the higher grades compared with about 1,100 women. In this light, the seeming female advantage in promotion rates is not unexpected. Nonetheless, the promotion of women into grades 13-15 is critical as these are "feeder" grades for executive

posts.[4] Also important is the finding that about 10 percent of the women scientists in GS 15 positions in 1974 had moved into the supergrades.

TABLE 2.6 Scientists and engineers full-time employed in the federal government 1974-1978: selected statistics on grade promotions

	Number at grade in 1974		% promoted between 1974 and 1978	
	Men	Women	Men	Women
All fields				
GS 11	17,934	1,053	47.7%	56.6%
GS 12	24,302	1,031	28.0	40.1
GS 13	25,422	740	18.3	27.5
GS 14	12,936	262	15.7	22.9
GS 15	6,772	105	5.4	9.5
Physical scientists				
GS 11	2,272	251	51.4%	45.0%
GS 12	3,785	182	29.2	30.8
GS 13	4,283	132	20.7	22.0
GS 14	2,370	34	19.0	35.3
GS 15	1,377	16	4.5	18.8
Bio-scientists				
GS 11	898	180	46.3	39.4
GS 12	1,103	133	37.3	33.9
GS 13	1,204	84	28.3	19.0
GS 14	645	35	21.3	25.7
GS 15	336	8	8.0	0.0

In the physical sciences and biosciences -- the two largest groups of scientists in the federal government -- the relative rates of promotions of women were favorable, except at the lower levels, where men moved up faster.

Whether or not one has a Ph.D. is generally thought to be less critical for advancement in the government than in academe. This view is supported by the fact that as of 1978 only one-third of the 1,844 scientists and engineers in the supergrades were Ph.D.s. Even so, it may be of interest to examine Ph.D.s separately in terms of promotions. Table 2.7 shows that male doctoral scientists and engineers were promoted out of GS 12-13 more frequently than were comparable women, whereas at GS 14-15, the women scientists had higher promotion rates. In biosciences, which include one-third of all doctoral women in the federal service, promotion of women lagged consistently behind that for men.

[4] See remarks made by the director of the Office of Personnel Management in box on page 26.

TABLE 2.7 Ph.D. scientists and engineers full-time employed in federal government 1974-1978: selected statistics on grade promotions

	Number at grade in 1974		% Promoted between 1974 and 1978	
	Men	Women	Men	Women
All fields				
GS 12	1,455	68	55.7	54.4
GS 13	2,850	104	35.3	33.6
GS 14	2,125	56	24.5	26.8
GS 15	1,514	27	5.9	11.1
Physical scientists				
GS 12	501	26	54.7	50.0
GS 13	969	31	36.5	32.2
GS 14	824	15	26.3	53.3
GS 15	654	7	4.6	28.6
Bioscientists				
GS 12	393	26	52.2	38.5
GS 13	710	43	33.0	23.3
GS 14	420	21	24.2	14.3
GS 15	243	7	8.2	0.0

Salary increases

How did women scientists and engineers fare in terms of salary increases over the 1974-1978 period? The following analysis of salaries is limited to persons full-time employed in the federal government in both years. Comparisons are controlled by age due to the disproportionately large number of women in the younger age groups.

TABLE 2.8 Salary increases for full-time staff 1974-1978: scientists and engineers in the federal government

	Median salaries, 1974		Median salaries, 1978		Average annual increase (%)	
Age in 1978	Men	Women	Men	Women	Men	Women
Under 30	$11,860	$10,860	$21,300	$20,800	15.8%	17.6%
30-34	15,980	15,690	24,790	24,540	11.5	13.0
35-39	20,370	19,190	28,070	26,580	8.3	8.5
40-44	23,140	20,290	32,090	27,830	8.5	8.2
45-49	24,510	20,750	32,770	28,750	7.5	8.5
50 and over	26,000	22,200	33,770	30,100	6.8	7.9

In general, median salaries for women scientists and engineers increased somewhat faster than those for men, resulting in a slightly narrower salary gap in 1978. In the 50-and-over age group, median salaries had increased at an average annual rate of 7.9 percent for women, compared with 6.8 percent for men; the salary differential remained substantial, however, at $3,700 in 1978. The largest differential occurred in the mid-career group -- those age 40-44 -- where women scientists and engineers were typically paid $4,300 less than men.

Women in Management

Women scientists and engineers were promoted to management positions at a faster rate than men in the same age groups -- a finding that is consistent with the data on grade promotions presented earlier. Only one in twenty of the women age 45 and over held managerial jobs in 1974, while one in ten did so four years later. Despite the recent progress, male scientists and engineers in the same age group were nearly twice as likely to be employed as managers in 1978 (Table 2.9).

TABLE 2.9 Scientists and engineers in the federal government: Percent in managerial positions* by age and sex

	1974 % Managers		1978 % Managers	
Age in 1974	Men	Women	Men	Women
Total	12.3	4.2	14.7	7.3
Under 30	5.6	4.5	8.3	6.4
30-34	7.1	2.8	9.7	6.8
35-39	11.4	4.0	15.0	6.2
40-44	14.1	2.9	17.1	7.7
45-49	16.9	5.8	18.3	10.2
50 and over	17.7	5.3	18.3	8.7

*Includes positions for which management, planning, or administration is the "functional classification".

NOTE: Includes only those employed in the federal government in both 1974 and 1978.

New Hires

Between 1974 and 1978 about 5,900 women scientists and engineers were hired into the Civil Service, accounting for 13 percent of the new accessions.

Table 2.10 shows the proportion of women among those hired from

outside the government by field of training, and separate statistics for the 10 agencies employing the largest numbers of scientists and engineers. Women comprised only two percent of the newly hired engineers but nearly 30 percent of the social scientists.

Within academic specialties there is considerable variation among agencies in the proportion of women hired. HEW ranked first in the proportion of women scientists hired -- close to 40 percent. Both NASA and the Veterans Administration (VA), show higher-than-average employment of women in at least eight out of nine fields, while the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) have a lower-than-average record in seven out of nine fields. The Defense Department is lower in all nine fields, for the lowest overall proportion of women scientists and engineers among these 10 agencies.

TABLE 2.10 PROPORTION OF WOMEN AMONG NEW HIRES: Proportion of women among scientists and engineers hired into the federal service between 1974 and 1978 (all degree levels)

Field*		All Agencies	Defense	USDA	HEW	VA	Interior	Commerce	Treasury	DOT	NASA	EPA
All science/engr. fields	%	13.4	7.3	11.8	38.5	21.6	10.2	20.3	23.8	9.5	16.5	10.1
Mathematicians/statisticians		25.7	19.7	29.3	31.1	26.3	22.9	36.2	29.5	29.6	52.9	13.6
Computer specialists		14.1	9.3	19.4	20.0	21.9	23.9	17.2	14.3	6.8	30.0	35.7
Physicists		5.8	3.7	18.2	15.2	7.7	6.7	3.1	0	0	22.4	3.8
Chemists		16.1	10.6	15.0	30.1	29.4	19.1	20.0	14.6	6.3	26.9	11.0
Other physical scientists		10.0	7.7	14.0	25.7	33.3	11.7	5.0	12.5	6.7	16.7	7.2
Engineers		2.3	1.8	3.0	5.6	1.6	2.7	2.5	1.1	2.6	5.5	3.6
Agricultural scientists		8.4	5.4	9.2	26.3	18.2	3.6	22.1	10.0	24.1	11.1	6.0
Bioscientists		21.4	19.6	16.4	45.9	26.7	11.3	23.4	54.5	15.4	50.0	18.5
Social scientists		28.6	18.5	31.5	45.0	33.8	26.3	30.3	28.6	24.2	27.8	24.5

*Field of highest degree. Specialities included in each of the field categories are shown in Appendix C.

Among Ph.D. scientists and engineers hired into the federal government since 1974, women account for only about 8 percent of the total, although they are more than 16 percent of the recent doctorate-holders (Table 2.11). In other words, the number of women Ph.D.s among new accessions is about half that suggested by their presence in the pool of new Ph.D.s. Their hiring rates, which vary considerably by field, most nearly correspond to availability in physics and mathematics.

TABLE 2.11 PROPORTION OF WOMEN AMONG NEW PH.D. HIRES: Proportion of women among Ph.D. scientists and engineers hired into the federal service between 1974 and 1978, and their percent availability among graduates during the same period.

Field of doctorate	% Women among new Ph.D. hires 1974 - 1978	% Women among Ph.D.s awarded 1974 - 1978
All science/engr. fields	8.3%	16.8%
Mathematicians/statisticians	9.2	11.7
Computer specialists	0.0	9.3
Physicists	4.0	4.9
Chemists	8.1	11.2
Other physical scientists	4.7	7.4
Engineers	1.3	1.9
Agricultural scientists	3.7	5.7
Bioscientists	11.3	23.4
Social scientists	15.5	26.8

Status of new hires

Examining the new accessions by highest degree earned and years since degree, it is evident that a woman scientist is typically hired at a lower grade than a comparable male (Table 2.12). This was found at all degree levels and number of years since the degree was earned.

Among Ph.D.s, the sex differences in starting salaries are slight, but for those six years or more past the doctorate, the differential grows to at least $2,400.

TABLE 2.12 MEDIAN GRADES AND MEDIAN SALARIES OF NEW HIRES: Median GS levels and salaries of scientists and engineers hired between 1974 and 1978 by highest degree earned, years since degree, and sex

Highest degree earned	Median grade 1978		Median salary, 1978 (full-time staff)	
	Men	Women	Men	Women
Bachelor's/Master's				
Years since:				
0	6.4	6.0	$16,100	$13,700
1-2	8.0	6.8	16,100	13,800
3-5	10.4	9.1	19,200	16,000
6-10	11.4	10.8	23,100	19,800
>10	12.5	11.1	29,500	23,400
Doctorate				
Years since:				
0	11.3	*	19,800	*
1-2	11.7	11.6	23,400	23,200
3-5	12.2	12.0	25,100	23,900
6-10	12.9	12.5	29,800	27,400
>10	14.0	13.0	37,500	31,700

*Fewer than 20 women.

Summary and Discussion

The federal government is a relatively minor employer of scientists and engineers, and the difference between the proportions of male and female scientists in government employment is much smaller than in industry. Nonetheless the disparities found -- in grade levels and therefore salaries -- closely parallel those in industry, with one major exception. That is that the higher promotion rates for women in recent years give some evidence of explicit efforts at equalization.

Of concern, however, is the continuing tendency to hire new women scientists at lower grade levels and salaries than men. While the extent of this practice has been reduced for recent doctorates, it is quite marked at the bachelor's and master's degree levels, which include the great majority of new hires. The imbalance created by the relative preponderance of women scientists at Grade 12 and below has increased since 1974.

While the finding that women were promoted to managerial positions more rapidly in the last few years is evidence of efforts at equalization, the fact that men in the same age groups are still twice as likely as women to be managers illustrates the magnitude of the inequalities which remain.

The available data do not identify causes for the sex differences.

For example, the analyses do not indicate to what extent the women scientists may have interrupted their careers in order to care for children and what impact this may have had on their long-term advancement in the government. A study of matched-pairs of men and women scientists in federal careers would offer the possibility of clarifying this issue.

CONCLUSIONS AND RECOMMENDATIONS

A comparison of industrial and government employment for women scientists and engineers suggests several parallels: in both sectors women and men are distributed differently both in terms of rank or grade level and in terms of work activities; women with identical education and work experience as men earn less and have less expectation of advancement. That this situation, a reflection of the general historical patterns of employment, should still obtain for older employees is perhaps no surprise: the very fact that they were disadvantaged in employment over a long period may now make them less experienced and knowledgeable and therefore less qualified. That newly trained women scientists face a very similar future despite nearly a decade of equal-opportunity mandates is cause for grave concern.

This is not to minimize the very real gains which have been made: the increases in the proportion of new hires in both government and industry, the reduction of salary differences for new hires in industry, and the growth in promotion rates and consequently salaries for women in government, represent significant advances. But they are only first steps.

While the percentage of women scientists employed in industry remains low, at about half that of their presence in the work force, it has increased dramatically in recent years. Even if women were hired at a utilization rate equivalent to men in each specialty, however, their total number in industry would remain relatively small in the forseeable future. This is especially true for minority women scientists who still represent less than one tenth of one percent of all doctoral scientists. For women in general, the proportions of new doctorates in the engineering, mathematical and physical sciences -- the dominant fields for Ph.D.s in industry -- are small and are expected to rise relatively slowly. Industrial employment of life and social scientists, with large fractions of women, is much lower than in the EMP fields.

Nonetheless, the disproportionately high unemployment rate of women scientists, especially in the physical sciences, suggests that recruiters may not be tapping this pool of available talent or that the doctoral women themselves may not be aware of opportunities in industry.[2]

A study to explore the reasons for low recruitment and hiring of women scientists in industry is now being planned by this Committee.

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[1]The conditions reported here also prevail in the academic sector, as documented in a previous report by this Committee, *Climbing the Academic Ladder: Doctoral Women Scientists in Academe.*

[2]As of 1977, unemployment rates for male and female Ph.D.s, respectively, were: in physics, 1.0 and 5.7 percent, and in chemistry, 0.9 and 5.0 percent. See *Science, Engineering, and Humanities Doctorates in the U.S., 1977 Profile*, p. 30.

Support of this effort is urged. Too little is known about general industrial needs and recruitment of doctoral scientists, on the one hand, and about the employment choices of women scientists on the other, to make any specific program recommendations at this time.

The markedly different distribution of primary work activities for men and women in industry suggests persistent sex stereotyping of jobs, which is generally recognized as the basic cause of salary differences. The fact that a disproportionately high fraction of women scientists and engineers remains engaged in basic or applied research, without promotion to management, and that their placement in "other", undefined work functions is even more unbalanced strongly implies a need for more effective equal opportunity monitoring at professional levels. A question that has been raised but cannot be answered at this time is to what extent women apply for these lower positions.

Salary differences between men and women persist even when controlled for field, full-time equivalent years of experience, or work function. Given the necessarily very small number of women scientists and engineers in a particular field, experience level, or function in a specific company, no general statistical analysis can reveal whether such differences may be justified in individual cases. The utility of regression analyses of the type widely used in assessing faculty salary differentials[3] should be explored. In any case it is recommended that, in addition to federal compliance requirements, companies internally conduct analyses of salaries and focus efforts on speedy rectification of any unjustified differences.

With regard to employment in federal agencies, where salaries are fixed according to grade levels, our data suggest that far more attention should be paid to equal initial job placements. If women scientists, on the average, are consistently assigned to lower starting grades than men regardless of their similarity in education and attainments, as our data indicate they are, then affirmative action within government agencies must focus on these initial grade placements. A special effort should be made to effect retroactive adjustments, where necessary, for women hired within the last few years.

Finally, greater attention must be paid to holders of other degrees. This Committee has been primarily concerned with doctoral women scientists and engineers in the past, although the above recommendations are intended to apply to bachelor's and master's degree recipients as well. Our brief review of government employment of women scientists and engineers at the lower degree levels shows that inequalities in grade assignment and consequently in salary are proportionately far more serious for this much larger group than for women doctorates. This finding suggests and urgent need to study in depth the employment of women with bachelor's and master's degrees in industry.

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[3]Alan E. Bayer and Helen S. Astin, *Sex Differentials in the Academic Reward System*, Science, Vol. 188, 1975, pp. 796-802.

The fresh recognition of the importance of industrial research and development to our national future underscores the need for full use of available talent and hence the salience of equal industrial employment opportunities for women scientists and engineers.

APPENDIX A
QUESTIONNAIRE

OMB No. 099-RO294

1977 SURVEY OF DOCTORATE RECIPIENTS

CONDUCTED BY THE NATIONAL RESEARCH COUNCIL WITH THE SUPPORT OF THE NATIONAL SCIENCE FOUNDATION, THE NATIONAL ENDOWMENT FOR THE HUMANITIES, AND THE NATIONAL INSTITUTES OF HEALTH

THE ACCOMPANYING LETTER requests your assistance in this biennial survey of Ph.D.'s in the humanities, sciences, and engineering.
PLEASE READ the instructions for each question carefully and answer by printing your reply or checking the appropriate box.
PLEASE CHECK the pre-printed information to be certain that it is correct and complete.
PLEASE RETURN the completed form in the enclosed envelope to the Commission on Human Resources, JH 638, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.
NOTE: THIS INFORMATION IS SOLICITED UNDER THE AUTHORITY OF THE NATIONAL SCIENCE FOUNDATION ACT OF 1950, AS AMENDED. ALL INFORMATION YOU PROVIDE WILL BE TREATED AS CONFIDENTIAL AND USED FOR STATISTICAL PURPOSES ONLY. INFORMATION WILL BE RELEASED ONLY IN THE FORM OF STATISTICAL SUMMARIES OR IN A FORM WHICH DOES NOT IDENTIFY INFORMATION ABOUT ANY PARTICULAR PERSON. YOUR RESPONSE IS ENTIRELY VOLUNTARY AND YOUR FAILURE TO PROVIDE SOME OR ALL OF THE REQUESTED INFORMATION WILL IN NO WAY ADVERSELY AFFECT YOU.

_____

_____

_____

If your name and address are incorrect, please enter correct information above. Include ZIP CODE.

If there is an alternate address through which you can always be reached, please provide it on the line below. (10)

C/O Number Street City State ZIP Code (11)

1. Date of Birth Mo. Day Year (12-16)	2. State or Foreign Country of Birth (17-18)	3. Citizenship 0 ☐ U.S.A. 1 ☐ Non-U.S.A., Specify Country _____ (19) (20-21)	4. Sex 1 ☐ M 2 ☐ F (22)

5. What is your racial background?
0 ☐ American Indian or Alaskan Native
1 ☐ Asian or Pacific Islander
2 ☐ Black
3 ☐ White
(23)

5a. Is your ethnic heritage Hispanic?
0 ☐ Yes
1 ☐ No
(24)

6. List in the table below all collegiate and graduate degrees, excluding honorary degrees, that have been awarded to you. Please check the pre-printed information, including the number and name of the specialty from the list on page 4, to be certain that it is correct and complete.

Type of Degree	Granted Mo. Yr.	Major Field (Use Specialties List) Name Number	Institution Name	City (or Campus) & State
Bachelor's				
Master's				
Doctorate				
Other (Specify) _____				

7. What was your employment status as of February 6-12, 1977? (Check only one category.)

Employed full-time in field of Ph.D. ☐ 1
Employed full-time in field other than field of Ph.D. ☐ 2
Employed part-time ☐ 3
Were you seeking full-time employment? 1 ☐ Yes 2 ☐ No (66)
Postdoctoral appointment (fellowship, traineeship, research associateship, etc.) ☐ 4
Unemployed and seeking employment ☐ 5
Not employed and not seeking employment ☐ 6
Retired and not employed ☐ 7
Other, specify: _____ ☐ 8
(65)

7a. If you were employed full-time during February 6-12, 1977, in a field other than your field of Ph.D., what was the MOST important reason for taking the position?

Preferred position outside Ph.D. field ☐ 1
Promoted out of position in Ph.D. field ☐ 2
Better pay ☐ 3
Locational factors ☐ 4
Position in Ph.D. field not available ☐ 5
Other, specify: _____ ☐ 6
(67)

If you checked 5, 6 or 7, ANSWER ONLY 8a, 9a, 13, 14 and 17 of the following questions.

8. Which category below best describes the type of organization of your principal employment OR postdoctoral appointment during February 6-12, 1977? (Check only one category.)

- Business or industry ☐ 1
- Junior college, 2-year college, technical institute ☐ 2
- Medical school ☐ 3
- 4-Year college ☐ 4
- University, other than medical school ☐ 5
- Elementary or secondary school system ☐ 6
- Private foundation ☐ 7
- Museum or historical society ☐ 8
- Research library or archives ☐ 9
- Hospital or clinic ☐ 10
- U.S. military service, active duty, or Commissioned Corps, e.g., USPHS, NOAA ☐ 11
- U.S. government, civilian employee ☐ 12
- State government ☐ 13
- Local or other government, specify: _____ ☐ 14
- Non-profit organization, other than those listed above ☐ 15
- Other, specify: _____ ☐ 16

(68-69)

8a. Which of the above categories best describes the type of organization related to your first position following the receipt of your doctorate? (List only one category)

_____
Type of Organization (70-71)

9. What percent of time did you devote to each of the following activities during the week of February 6-12, 1977? (Total should equal 100%) **What were your primary (A) and secondary (B) work activities?** (Check only one in each column.)

	%		A	B
Management or administration of				
Research and development	_____	(10)	☐ 1	☐
Other than research and development	_____	(12)	☐ 2	☐
Both	_____	(14)	☐ 3	☐
Basic research	_____	(16)	☐ 4	☐
Applied research	_____	(18)	☐ 5	☐
Development of equipment, products, systems, data	_____	(20)	☐ 6	☐
Development of humanities resource materials	_____	(22)	☐ 7	☐
Design	_____	(24)	☐ 8	☐
Teaching	_____	(26)	☐ 9	☐
Writing, editing	_____	(28)	☐ 10	☐
Curatorial	_____	(30)	☐ 11	☐
Production	_____	(32)	☐ 12	☐
Consulting, specify: _____	_____	(34)	☐ 13	☐
Professional services to individuals	_____	(36)	☐ 14	☐
Quality control, inspection, testing	_____	(38)	☐ 15	☐
Sales, marketing, purchasing, estimating	_____	(40)	☐ 16	☐
Other, specify: _____	_____	(42)	☐ 17	☐
	Total = 100%		(44-47)	

9a. Which of the above categories best describes the primary work activity related to your first position following the receipt of your doctorate?

_____
Primary Work Activity Number (48-49)

10. From the Degree and Employment Specialties List on page 4 select and enter both the number and title of the employment specialty most closely related to your principal employment or postdoctoral appointment during the week of February 6-12, 1977. Write in your specialty if it is not on the list.

_____
Number Title of Employment Specialty (50-52)

11. Please give the name of your principal employer (organization, company, etc. or, if self employed, write "self"), and actual place of employment as of the week of February 6-12, 1977.

_____
Name of Employer (53-58)

_____
Number Street

_____
City State ZIP Code (59-63)

12. What was the basic annual salary* associated with your principal professional employment during the week of February 6-12, 1977? If you were on a postdoctoral appointment (e.g., fellowship, traineeship, research associateship), what was your annual stipend plus allowances?

$ _____ per year (64-66)

*NOTE: Basic annual salary is your annual salary before deductions for income tax, social security, retirement, etc., but does not include bonuses, overtime, summer teaching, or other payment for professional work.

IF ACADEMICALLY EMPLOYED:

a Check whether salary was for ☐ 9-10 months or ☐ 11-12 months. (67)

b Did you hold a tenured position during February 6-12, 1977? 0 ☐ Yes 1 ☐ No (68)
If Yes, what year was tenure granted? _____ (69-70)

c What was the rank of your position? (Check only one.)

- 1 ☐ Professor
- 2 ☐ Associate Professor
- 3 ☐ Assistant professor
- 4 ☐ Instructor
- 5 ☐ Lecturer
- 6 ☐ Other, specify: _____ (71)

d What, if any, administrative position did you hold?

- 1 ☐ Dean
- 2 ☐ Department Chairman
- 3 ☐ President or Chancellor
- 4 ☐ Vice-President or Vice-Chancellor
- 5 ☐ Other, specify: _____
- 6 ☐ Does not apply

(72)

13. **How many full-time equivalent years of professional work experience, including teaching, have you had?** _____ **Year(s)**
(73-74)

14. **Following completion of your doctorate have you ever held a fellowship, traineeship, or research associateship?** 0 ☐ Yes 1 ☐ No
(75)

15. **Listed below are selected topics of national interest. If you devoted a proportion of your professional time which you considered significant to any of these problem areas during the week of February 6-12, 1977, please check the box for the one on which you spent the MOST time.**

1 ☐ Health
2 ☐ Defense
3 ☐ Environmental protection, pollution control
4 ☐ Education
5 ☐ Space
6 ☐ Crime prevention and control
7 ☐ Energy and fuel
8 ☐ Food and other agricultural products
9 ☐ Natural resources,other than fuel or food
10 ☐ Community development and services
11 ☐ Housing (planning, design, construction)
12 ☐ Transportation, communications
13 ☐ Cultural life
14 ☐ Other area, specify: _____
15 ☐ Does not apply
(10-11)

16. **Was any of your work in the week of February 6-12, 1977 supported or sponsored by U.S. Government funds?**

0 ☐ Yes 1 ☐ No 2 ☐ Don't know (12)

If Yes, which of the following federal agencies or departments were supporting the work? (Check all that apply.)

13 ☐ Agency for International Development
14 ☐ Energy Research & Development Administration
15 ☐ Environmental Protection Agency
16 ☐ National Aeronautics & Space Administration
17 ☐ National Endowment for the Arts
18 ☐ National Endowment for the Humanities
19 ☐ National Science Foundation
20 ☐ Nuclear Regulatory Commission
21 ☐ Smithsonian Institution
22 ☐ Department of Agriculture
23 ☐ Department of Commerce
24 ☐ Department of Defense

Department of Health, Education, and Welfare
25 ☐ National Institutes of Health
26 ☐ Alcohol, Drug Abuse & Mental Health Administration
27 ☐ National Institute of Education
28 ☐ Office of Education
29 ☐ Other, specify: _____
30 ☐ Department of Housing and Urban Development
31 ☐ Department of the Interior
32 ☐ Department of Justice
33 ☐ Department of Labor
34 ☐ Department of State
35 ☐ Department of Transportation
36 ☐ Other agency or department, specify: _____
37 ☐ Don't know source agency

17. **If you received your doctoral degree in science or engineering or are employed as a scientist or engineer, please check all that apply below:**

☐ (a) Changed positions during the period 1973 to 1976.
☐ (b) Received doctoral degree in 1965 or later and employed sometime since receiving your doctoral degree in industry, government, or as non-faculty academic staff.
☐ (c) Held a postdoctoral appointment any year during 1970-1976 inclusive.
☐ (d) None of the above apply.
(38-41)

If you have checked a, b, or c, please give a brief career history starting with the position prior to your present position and continuing back in time for a maximum of four positions after receiving your doctoral degree (Include postdoctoral appointments).

Name and Location (City and State) of Employer	Position Title	Dates Held	Primary Work Activity*	Employment Specialty (Use Degree & Employment Specialties List)	Reason for Leaving Position
1.					
2.					
3.					
4.					

*Enter code (1-17) from the list given in item 9

(a) Of the positions described above, as well as your present position, please check any in which your doctoral training was/is not being used.
☐ Position 1 ☐ Position 2 ☐ Position 3 ☐ Position 4 ☐ Present Position ☐ None

(74-79)

DEGREE AND EMPLOYMENT SPECIALTIES LIST

MATHEMATICAL SCIENCES

000 - Algebra
010 - Analysis & Functional Analysis
020 - Geometry
030 - Logic
040 - Number Theory
052 - Probability
055 - Math. Statistics (see also 544, 670, 725, 729)
060 - Topology
082 - Operations Research (see also 478)
085 - Applied Mathematics
089 - Combinatorics & Finite Mathematics
091 - Physical Mathematics
098 - Mathematics, General
099 - Mathematics, Other*

COMPUTER SCIENCES

071 - Theory
072 - Software Systems
073 - Hardware Systems
074 - Intelligent Systems
079 - Computer Sciences, Other

PHYSICS & ASTRONOMY

101 - Astronomy
102 - Astrophysics
110 - Atomic & Molecular Physics
120 - Electromagnetism
130 - Mechanics
132 - Acoustics
134 - Fluids
135 - Plasma Physics
136 - Optics
138 - Thermal Physics
140 - Elementary Particles
150 - Nuclear Structure
160 - Solid State
198 - Physics, General
199 - Physics, Other*

CHEMISTRY

200 - Analytical
210 - Inorganic
215 - Synthetic Inorganic & Organometallic
220 - Organic
225 - Synthetic Organic & Natural Products
230 - Nuclear
240 - Physical
245 - Quantum
250 - Theoretical
255 - Structural
260 - Agricultural & Food
265 - Thermodynamics & Material Properties
270 - Pharmaceutical
275 - Polymers
280 - Biochemistry (see also 540)
285 - Chemical Dynamics
298 - Chemistry, General
299 - Chemistry, Other*

EARTH, ENVIRONMENTAL AND MARINE SCIENCES

301 - Mineralogy, Petrology
305 - Geochemistry
310 - Stratigraphy, Sedimentation
320 - Paleontology
330 - Structural Geology
341 - Geophysics (Solid Earth)
350 - Geomorph. & Glacial Geology
391 - Applied Geol., Geol. Engr. & Econ. Geol.
395 - Fuel Tech. & Petrol. Engr. (see also 479)
360 - Hydrology & Water Resources
370 - Oceanography
397 - Marine Sciences, Other*
381 - Atmospheric Physics & Chemistry
382 - Atmospheric Dynamics
383 - Atmospheric Sciences, Other*
388 - Environmental Sciences, General (see also 480, 528)
389 - Environmental Sciences, Other*
398 - Earth Sciences, General
399 - Earth Sciences, Other*

ENGINEERING

400 - Aeronautical & Astronautical
410 - Agricultural
415 - Biomedical
420 - Civil
430 - Chemical
435 - Ceramic
440 - Electrical
445 - Electronics
450 - Industrial & Manufacturing
455 - Nuclear
460 - Engineering Mechanics
465 - Engineering Physics
470 - Mechanical
475 - Metallurgy & Phys. Met. Engr.
476 - Systems Design & Systems Science (see also 072, 073, 074)
478 - Operations Research (see also 082)
479 - Fuel Technology & Petrol. Engr.
480 - Sanitary & Environmental
486 - Mining
497 - Materials Science Engr.
498 - Engineering, General
499 - Engineering, Other*

AGRICULTURAL SCIENCES

500 - Agronomy
501 - Agricultural Economics
502 - Animal Husbandry
504 - Fish & Wildlife
505 - Forestry
506 - Horticulture
507 - Soils & Soil Science
510 - Animal Science & Animal Nutrition
511 - Phytopathology
517 - Food Science & Technology (see also 573)
518 - Agriculture, General
519 - Agriculture, Other*

MEDICAL SCIENCES

520 - Medicine & Surgery
522 - Public Health & Epidemiology
523 - Veterinary Medicine
524 - Hospital Administration
526 - Nursing
527 - Parasitology
528 - Environmental Health
534 - Pathology
536 - Pharmacology
537 - Pharmacy
538 - Medical Sciences, General
539 - Medical Sciences, Other*

BIOLOGICAL SCIENCES

540 - Biochemistry (see also 280)
542 - Biophysics
543 - Biomathematics
544 - Biometrics, Biostatistics (see also 055, 670, 725, 729)
545 - Anatomy
546 - Cytology
547 - Embryology
548 - Immunology
550 - Botany
560 - Ecology
562 - Hydrobiology
564 - Microbiology & Bacteriology
566 - Physiology, Animal
567 - Physiology, Plant
569 - Zoology
570 - Genetics
571 - Entomology
572 - Molecular Biology
573 - Food Science & Technology (see also 517)
574 - Behavior/Ethology
576 - Nutrition & Dietetics
578 - Biological Sciences, General
579 - Biological Sciences, Other*

PSYCHOLOGY

600 - Clinical
610 - Counseling & Guidance
620 - Developmental & Gerontological
630 - Education
635 - School Psychology
641 - Experimental
642 - Comparative
643 - Physiological
650 - Industrial & Personnel
660 - Personality
670 - Psychometrics (see also 055, 544, 725, 729)
680 - Social
698 - Psychology, General
699 - Psychology, Other*

SOCIAL SCIENCES

700 - Anthropology
703 - Archeology
708 - Communications*
709 - Linguistics
710 - Sociology
720 - Economics (see also 501)
725 - Econometrics (see also 055, 544, 670, 729)
729 - Social Statistics (see also 055, 544, 670, 725)
740 - Geography
745 - Area Studies*
751 - Political Science
752 - Public Administration
755 - International Relations
770 - Urban & Regional Planning
775 - History & Philosophy of Science
798 - Social Sciences, General
799 - Social Sciences, Other*

HUMANITIES

802 - History & Criticism of Art
804 - History, American
805 - History, European
806 - History, Other*
808 - American Studies
830 - Music
831 - Speech as a Dramatic Art (see also 885)
833 - Religion (see also 881)
834 - Philosophy
836 - Comparative Literature
878 - Humanities, General
879 - Humanities, Other*
891 - Library & Archival Sciences

LANGUAGES & LITERATURE

811 - American
812 - English
821 - German
822 - Russian
823 - French
824 - Spanish & Portuguese
826 - Italian
827 - Classical*
829 - Other Languages*

EDUCATION & OTHER PROFESSIONAL FIELDS

938 - Education
801 - Art, Applied
881 - Theology (see also 833)
882 - Business Administration
883 - Home Economics
884 - Journalism
885 - Speech & Hearing Sciences (see also 831)
886 - Law, Jurisprudence
887 - Social Work
897 - Professional Field, Other*

899 - OTHER FIELDS*

*Identify the specific field in the space on the questionnaire.

APPENDIX B
SAMPLING ERRORS FOR THE
1977 SURVEY OF DOCTORATE RECIPIENTS

As noted on page 3, data from the National Research Council's Survey of Doctorate Recipients is subject to error due to sampling variability. Estimated sampling errors for selected statistics on women in industry are provided below (Tables B-1 and B-2).

Sampling errors for percent statistics. The sampling errors for percent statistics were computed as $s = \sqrt{\frac{pq}{n}}$ where

p = the percent x 100

q = 1 - p

and n = the size of the sample on which the percent is based.

The finite population correction factor, $\sqrt{\frac{N-n}{N-1}}$, has been omitted since it would have a negligible effect on most of the calculated errors.[1] The above formula also assumes a simple random sample whereas a stratified random sample was used. However, it has been shown that alternate standard error calculations, taking stratification into account, yield estimates that are quite similar to those derived from the more general formula used here.[2]

[1]As a result of omitting the finite population correction factor, the sampling error will be somewhat overestimated.

[2]Betty D. Maxfield, Nancy C. Ahern, and Andrew W. Spisak, *Science, Engineering and Humanities Doctorates in the United States: 1977 Profile* (Washington, D.C.: National Academy of Science, 1978) pp. 78-79. See comparison of sampling errors based on (i) a simple random sample, and (ii) the stratified random sample, for the 1977 Survey of Doctorate Recipients.

TABLE B-1 Estimated sampling errors (in parentheses) for selected statistics on doctoral women scientists in industry, 1977

	Men	Women
% Employed in business/industry		
All Ph.D.s	25.4 (0.3)	7.0 (0.3)
New Ph.D.s	25.1 (0.9)	9.1 (1.0)
% Women among Ph.D.s in industry		
Engineering, mathematics, and physical sciences	n/a	1.9 (0.2)
Life sciences	n/a	4.8 (0.6)
Behavioral & social sciences	n/a	9.5 (1.5)
% Distribution of doctoral scientists and engineers in industry by primary work activity		
Management of R & D	27.7 (0.6)	13.5 (1.5)
Basic research	6.7 (0.3)	14.8 (1.5)
Applied research	25.5 (0.6)	29.3 (1.9)
Development	16.3 (0.5)	7.0 (1.1)
Management of non-R & D	9.5 (0.4)	4.6 (0.9)
Other activities	14.3 (0.5)	30.9 (2.0)
% of Ph.D.s in industry who earned doctorate from prestigious department		
1970-1976 Ph.D.s	40.6 (1.0)	40.9 (2.7)
1975-1976 Ph.D.s only	39.5 (2.0)	37.8 (4.5)
% of recent Ph.D.s in industry who had received postdoctoral training		
Physics	39.9 (4.2)	12.8 (7.3)
Chemistry	38.0 (2.2)	30.4 (4.3)
Medical sciences	41.2 (4.7)	23.0 (10.9)
Biological sciences	37.0 (3.6)	45.3 (8.4)

60-781 O - 80 - 9

Sampling errors for median salaries. Sampling errors were computed for all median salary figures shown in Part 1 of this report.[3] The sampling error estimates, again assuming a simple random sample, were computed as follows:

1. Since the median is the estimated 50th percentile figure, the sampling error for p = .50 was calculated:

$$\sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{.50(.50)}{n}} = \sqrt{\frac{.25}{n}}$$

2. The above resulted in an upper and lower bound on .50. Multiplied by 100, these were translated to upper and lower percentiles.

3. The salaries associated with the upper and lower percentile figures were then calculated, providing a two-thirds confidence interval for the median salary.[4]

> Example: The estimated median salary in 1977 for recent women Ph.D.s in industry is $22,100 (Table 1.10). This is based on a sample of 305 such women. In this case, the sampling error for p = .50 is:
>
> $$\sqrt{\frac{.50(.50)}{n}} = \sqrt{\frac{.25}{305}} = .03$$
>
> Given that p =.50 $\pm$ .03, the upper and lower percentiles of interest are (.05 - .03)100 and (.05 + .03)100 or the 47th and 53rd percentiles. Next, the 47th and 53rd percentile salaries for the recent women Ph.D.s are computed--$21,900 and $22,400. The two-thirds confidence interval for the estimate of $22,100 is thus $21,900-$22,400.

---

[3]The procedure for estimating sampling errors of medians was derived from Morris H. Hansen, William N. Hurwitz, and William G. Madow, *Sample Survey Methods and Theory*, vol. 1 (New York: John Wiley & Sons, Inc., 1953), pp. 448-449.

[4]For readers not familiar with this term, a two-thirds confidence interval is the interval from one standard error or sampling error below the estimate to one standard error above the estimate. With two-thirds or 67 percent confidence, the interval includes the average result that would have been obtained from all possible samples of the same design.

It should be noted that the confidence intervals for the median salaries are generally not symmetric. This is because the salaries tend to be more variable above the median than below the median.

Table B-2 below shows the estimated confidence intervals for median salaries that appeared in text Tables 1.7-1.9 and Figures 1.3-1.4.

TABLE B-2. Estimated confidence intervals for median salaries, doctoral scientists and engineers in industry

From:				($ in thousands) Median salary	2/3 Confidence interval[a]
TABLE 1.7	1934-1957 Ph.D.s:				
	All fields	(1973)	Men	$28.1	$27.9-28.4
			Women	22.3	21.7-22.9
		(1977)	Men	37.7	37.3-38.0
	EMP fields	(1973)	Men	27.7	27.4-28.2
			Women	22.1	21.2-22.7
		(1977)	Men	37.4	36.8-38.0
	Life sciences	(1973)	Men	28.9	28.3-29.6
		(1977)	Men	37.8	36.6-38.9
	1958-1969 Ph.D.s:				
	All fields	(1973)	Men	22.8	22.7-22.9
			Women	20.5	20.2-20.8
		(1977)	Men	31.4	31.2-31.6
			Women	27.5	26.6-28.2
	EMP fields	(1973)	Men	22.7	22.6-22.8
			Women	20.4	20.0-20.8
		(1977)	Men	31.3	31.1-31.5
			Women	27.2	26.3-27.9
	Life sciences	(1973)	Men	23.1	22.8-23.4
			Women	19.7	19.0-20.4
		(1977)	Men	32.0	30.8-32.6
			Women	26.9	25.7-28.5
	Behavioral and social sciences	(1973)	Men	27.7	25.9-29.0
	1970-1972 Ph.D.s:				
	All fields	(1973)	Men	18.7	18.6-18.8
			Women	16.3	15.7-16.9
		(1977)	Men	26.8	26.5-27.1
			Women	24.0	23.2-24.4
	EMP fields	(1973)	Men	18.7	18.6-18.8
			Women	16.4	15.7-17.0
		(1977)	Men	26.8	26.5-27.1
			Women	23.5	22.5-24.1
	Life sciences	(1973)	Men	17.7	17.5-17.9
			Women	14.8	14.3-15.5
		(1977)	Men	25.6	25.1-26.1
			Women	22.3	21.7-22.9
	Behavioral and social sciences	(1973)	Men	20.2	19.0-20.8
			Women	17.5	17.2-17.8
		(1977)	Men	29.8	28.5-30.9
			Women	30.4	28.6-32.1

[a]There is 2/3 or 67 percent confidence that the interval includes the value being estimated.

TABLE B-2. (continued) Estimated confidence intervals for median salaries, doctoral scientists and engineers in industry

From:			Median salary ($ in thousands)	2/3 Confidence interval[a] ($ in thousands)
FIGURE 1.3	1934-1957 Ph.D.s	Men	$37.7	$37.3-38.0
		Women	30.0	27.9-31.6
	1958-1969 Ph.D.s	Men	31.4	31.2-31.6
		Women	27.5	26.6-28.2
	1970-1972 Ph.D.s	Men	26.8	26.5-27.1
		Women	24.0	23.2-24.4
	1973-1974 Ph.D.s	Men	24.2	24.1-24.4
		Women	21.3	20.8-22.3
	1975-1976 Ph.D.s	Men	21.6	21.5-21.7
		Women	21.2	20.7-21.6
TABLE 1.8	All fields			
	2 years experience or less	Men	21.0	20.8-21.2
		Women	19.5	19.0-20.0
	3-5 years	Men	23.0	22.8-23.2
		Women	20.9	20.6-21.3
	6-9 years	Men	26.8	26.6-27.1
		Women	25.4	24.5-26.4
	10-14 years	Men	30.3	30.2-30.4
		Women	28.2	26.5-29.2
	15-19 years	Men	33.1	32.7-33.5
		Women	27.2	26.3-28.9
	20-24 years	Men	35.4	35.0-35.8
		Women	28.4	27.5-30.3
	25 years or more	Men	37.6	36.9-38.3
	EMP fields			
	2 years experience or less	Men	21.2	21.0-21.4
		Women	20.5	19.9-21.1
	3-5 years	Men	23.0	22.9-23.2
		Women	21.6	20.9-22.1
	6-9 years	Men	26.9	26.7-27.2
		Women	24.6	24.0-25.8
	10-14 years	Men	30.3	30.1-30.4
		Women	25.7	25.1-26.9
	15-19 years	Men	32.7	32.4-33.1
		Women	26.8	25.3-28.1
	20-24 years	Men	35.0	34.5-35.4
		Women	28.3	27.4-30.1
	25 years or more	Men	37.5	36.9-38.2
		Women	30.4	29.0-31.9
	Life sciences			
	2 years experience or less	Men	$19.3	$18.8-19.8
	3-5 years	Men	22.9	22.5-23.3
		Women	20.5	19.9-21.1
	6-9 years	Men	25.7	25.3-26.3
		Women	23.1	22.3-24.2
	10-14 years	Men	30.3	30.0-30.6
	15-19 years	Men	35.8	35.3-36.5
	20-24 years	Men	36.2	35.3-37.4
	25 years or more	Men	37.6	35.9-39.0
		Women	28.2	26.1-30.0
	Behavioral & social sciences			
	3-5 years experience	Men	23.2	22.2-24.7
	6-9 years	Men	27.8	26.6-29.5
	10-14 years	Men	31.4	30.6-32.5
		Women	30.2	29.6-32.2

[a]There is 2/3 or 67 percent confidence that the interval includes the value being estimated.

TABLE B-2. (continued) Estimated confidence intervals for median salaries, doctoral scientists and engineers in industry

From:		Median salary ($ in thousands)	2/3 Confidence interval[a] ($ in thousands)
TABLE 1.9 EMP fields			
Performance of R&D			
2 years experience or less	Men	21.4	21.1-21.6
	Women	21.2	20.8-21.5
3-5 years	Men	23.2	23.1-23.4
	Women	22.4	22.1-22.8
6-9 years	Men	26.0	25.7-26.2
	Women	25.2	24.5-26.3
10-14 years	Men	28.9	28.8-29.2
	Women	26.3	25.0-28.4
15-19 years	Men	30.0	29.5-30.3
	Women	25.1	24.5-26.3
Management of R&D			
3-5 years	Men	23.4	22.6-24.3
	Women	18.8	18.1-20.6
6-9 years	Men	30.0	29.6-30.3
	Women	23.9	23.2-31.0
10-14 years	Men	32.0	31.5-32.5
	Women	25.8	25.2-27.5
15-19 years	Men	36.1	35.6-36.5
	Women	34.4	33.0-36.2

[a]There is 2/3 or 67 percent confidence that the interval includes the value being estimated.

APPENDIX C
DEFINITION OF FEDERALLY EMPLOYED SCIENTISTS AND ENGINEERS

For the analyses in Part 2 of this report, scientists and engineers were defined as individuals who had earned degrees in science and engineering and who were employed in selected scientific, engineering, or administrative positions, according to the Central Personnel Data File.[1]

Degree criteria. Only those persons who had earned a baccalaureate or higher degree in a science or engineering field were selected. The academic discipline codes that were included are shown in Table C-1. Individuals with professional degrees in medicine and law as their highest degree were not included.

Occupation criteria. The population was further restricted to persons employed in selected professional scientific and engineering positions or in certain administrative categories. The occupational codes and corresponding titles are listed in Table C-2.

Primary job function. Those engaged primarily in clinical practice, as indicated by "functional classification", were excluded from the analyses.

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[1]The file, which is maintained by the Office of Personnel Management, is briefly described on page 3 of this report.

TABLE C-1 Definition of Science and Engineering Fields*

Name of Field	Code
Mathematics/statistics	
Mathematics, general	1701
Statistics, mathematical & theoretical	1702
Applied mathematics	1703
Other, related	1799
Operations research	0507
Computer sciences	
Computer and information sciences, general	0701
Information sciences & systems	0702
Data processing	0703
Computer programming	0704
Systems analysis	0705
Other, related	0799
Physics	
Physics, general (excluding biophysics)	1902
Molecular physics	1903
Nuclear physics	1904
Chemistry	
Chemistry, general (excludes biochemistry)	1905
Inorganic chemistry	1906
Organic chemistry	1907
Physical chemistry	1908
Analytical chemistry	1909
Pharmaceutical chemistry	1910
Other physical sciences	
Physical sciences, general	1901
Astronomy	1911
Astrophysics	1912
Atmospheric sciences & meteorology	1913
Geology	1914
Geochemistry	1915
Geophysics & seismology	1916
Earth sciences, general	1917
Paleontology	1918
Oceanography	1919
Metallurgy	1920
Other, related	1999

Name of Field	Code
Engineering	
Engineering, general	0901
Aerospace, aeronautical, astronautical	0902
Agricultural	0903
Bioengineering and biomedical	0905
Chemical engineering (includes petroleum refining)	0906
Petroleum engineering (excludes petroleum refining)	0907
Civil, construction, transportation	0908
Electrical, electronics, communications	0909
Mechanical	0910
Geological	0911
Geophysical	0912
Industrial & management	0913
Metallurgical	0914
Materials	0915
Ceramic	0916
Textile	0917
Mining, mineral	0918
Engineering physics	0919
Nuclear	0920
Engineering mechanics	0921
Environmental, sanitary	0922
Ocean	0924
Engineering technologies (B.S. & higher)	0925
Other, related	0999
Agricultural sciences	
Agriculture, general	0101
Agronomy (field crops, crops management)	0102
Soils science (management, conservation)	0103
Animal science (husbandry)	0104
Dairy science (husbandry)	0105
Poultry science	0106
Fish, game, wildlife management	0107
Horticulture (fruit, vegetable production)	0108
Ornamental horticulture (floriculture, nursery science)	0109
Agricultural, farm management	0110
Agricultural economics	0111
Food science, technology	0113
Forestry	0114
Natural resources management	0115
Agriculture, forestry technologies (B.S. & higher)	0116
Range management	0117
Other, related	0199
Environmental design, general	0201
City, community, regional planning	0206

*Based on the "academic discipline" of highest degree earned, as indicated in the Central Personnel Data File.

TABLE C.1 (continued)

Biological sciences	Code
Biological, general	0401
Botany, general	0402
Bacteriology	0403
Plant pathology	0404
Plant pharmacology	0405
Plant physiology	0406
Zoology, general	0407
Pathology, human & animal	0408
Pharmacology, human & animal	0409
Physiology, human & animal	0410
Microbiology	0411
Anatomy	0412
Histology	0413
Biochemistry	0414
Biophysics	0415
Molecular biology	0416
Cell biology (cytology, cell physiology)	0417
Marine biology	0418
Biometrics, biostatistics	0419
Ecology	0420
Entomology	0421
Genetics	0422
Radiobiology	0423
Nutrition, scientific (excludes nutrition in home economics and dietetics)	0424
Neurosciences	0425
Toxicology	0426
Embryology	0427
Wildlife biology	0498
Other, related	0499
Foods, nutrition	1306

Social sciences	Code
Psychology, general	2001
Experimental psychology	2002
Clinical psychology	2003
Psychology for counseling	2004
Social psychology	2005
Psychometrics	2006
Statistics in psychology	2007
Industrial psychology	2008
Developmental psychology	2009
Physiological psychology	2010
Other, related	2099
Family relations, child development	1305
Social sciences, general	2201
Anthropology	2202
Archaeology	2203
Economics	2204
Geography	2206
Political science, government	2207
Sociology	2208
Criminology	2209
International relations	2210
Afro-American cultural studies	2211
American Indian studies	2212
Mexican-American cultural studies	2213
Urban studies	2214
Demography	2215
Other, related	2299
Communications, general	0601
Linguistics	1505
Area studies	0301 to 0399
Public administration	2102
Biological and physical sciences & engineering, general	4902,4904

TABLE C-2 Occupational Titles Included in the Federal Employment Analyses (only for those with degrees in science and engineering)

PROFESSIONAL

CODE	TITLE
1510	Actuary
1515	Operations research
1520	Mathematics
1529	Mathematical statistician
1530	Statistician
1310	Physics
1320	Chemistry
1301	General physical science
1313	Geophysics
1315	Hydrology
1321	Mettalurgy
1330	Astronomy & space science
1340	Meteorology
1350	Geology
1360	Oceanography
1372	Geodesy
0801	General engineering
0803	Safety engineering
0804	Fire prevention engineering
0806	Materials engineering
0810	Civil engineering
0819	Sanitary engineering
0830	Mechanical engineering
0840	Nuclear engineering
0850	Electrical engineering
0855	Electronics engineering
0858	Biomedical engineering
0861	Aerospace engineering
0880	Mining engineering
0881	Petroleum engineering
0890	Agricultural engineering
0892	Ceramic engineering
0893	Chemical engineering
0894	Welding engineering
0896	Industrial engineering

CODE	TITLES
0406	Agricultural extension
0434	Plant pathology
0436	Plant protection&quarantine
0437	Horticulture
0454	Range conservation
0457	Soil conservation
0460	Forestry
0470	Soil science
0471	Agronomy
0475	Agricultural management
0480	General fish & wildlife
0482	Fishery biology
0485	Wildlife refuge management
0486	Wildlife biology
0487	Husbandry
1306	Health physics
0401	General biological science
0403	Microbiology
0405	Pharmacology
0410	Zoology
0413	Physiology
0414	Entomology
0430	Botany
0435	Plant physiology
0440	Genetics
0101	Social science
0110	Economist
0130	Foreign affairs
0131	International relations
0135	Foreign agricultural affairs
0140	Manpower research and analysis
0150	Geography
0180	Psychology
0184	Sociology
0190	General anthropology
0193	Archeology
1370	Cartography
1373	Land surveying
0020	Community planning

ADMINISTRATIVE

0301	General clerical & administrative
0330	Digital computer systems
0334	Computer specialist
0340	Program management
0341	Administrative officer
0342	Office services management
0343	Management analysis
0345	Program analysis
0346	Logistics management
0391	Communications management
0132	Intelligence
0136	International cooperation

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SCIENCE

APPENDIX D

Baccalaureate Origins of American Scientists and Scholars

M. Elizabeth Tidball and Vera Kistiakowsky

Baccalaureate Origins of American Scientists and Scholars

The undergraduate institutions from which women have gone on to doctorates differ from those of men.

M. Elizabeth Tidball and Vera Kistiakowsky

Until the passage of federal antibias regulations pertaining to women in institutions of higher education, few of these institutions found it necessary or useful to examine themselves for evidence of policies or attitudes that affect women and men differentially. As a result there have been very few studies that would enable the characterization of colleges and universities with respect to their advancement of the status of women (*1*).

The present article is concerned with but one aspect of such a characterization: institutional productivity in terms of baccalaureate recipients who have subsequently earned research doctorates (*2*). The productivity of an institution is here measured in two ways: by the absolute number of its graduates of each sex who went on to attain the doctorate, and by the percentage of its graduates of each sex who did so. Both these productivities have been assessed also with respect to the decades when the baccalaureates were granted and to the various fields of doctoral study. Apart from their intrinsic historical interest, it is hoped that these data will suggest ways of characterizing educational institutions that will describe more fully their involvement in the higher education of women.

Historical Perspective

Early in the 17th century the first American colleges were founded—for men. Two hundred years later the notion that women were also educable found expression in the establishment by Emma Willard of Troy Female Seminary (1821) and by Mary Lyon of Mount Holyoke Female Seminary (1837). While neither institution was chartered to grant the baccalaureate degree, both offered two or more years of courses in all academic disciplines patterned after those available in the best men's colleges and universities (*3*). In 1837 Oberlin College became the first institution to admit women to a baccalaureate degree program, although full access to all courses and departments was not permitted until some time later. By the 1870's there were 97 major coeducational institutions (*4*) and some 28 women's colleges (*5*) in the United States.

Women were not admitted to graduate schools before the 1880's, and even after they had gained admission they were not necessarily permitted to receive advanced degrees (*6*). Nonetheless by 1920, the first year in which doctorate

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degrees were recorded by the National Research Council, 88, or 16 percent, of the recipients were women (*7*). Since that time the number of women receiving doctorates has grown rather steadily. The percentage of doctorates awarded to women also increased for a time, reaching a peak in 1945 of 21 percent. But after the years of World War II it declined to a low of 9 percent in 1954. Not until 1972 did the proportion again reach the level of the 1920's; and only in 1974 had it returned to the range recorded in the mid-1940's.

The baccalaureate origins of these women have not been investigated previously. Harmon and Soldz (*8*) have published an extensive survey of doctorate production in the United States which includes a rank ordering of baccalaureate institutions by number of doctorate recipients according to the decade of receiving the doctorate. A second study, carried out at the City University of New York (*9*), rank-orders 20 baccalaureate institutions by the number of graduates who received doctorates in each of 22 fields. A third study, by Hardy (*10*), rank-orders baccalaureate institutions according to the percentage of graduates who earned doctorates during the years 1920–1939 and 1950–1961. None of these studies has given results separately for women and for men.

Only a few studies have been published which focus on institutional productivities for women. In one (*11*), 1500 women randomly selected from all those cited for career achievement in *Who's Who of American Women* served as the data base. Their baccalaureate degrees had come from 59 women's colleges and 289 coeducational institutions. In proportion to the total number of women graduates in their respective graduating classes, the women's colleges had twice the representation in this sample that the coeducational institutions had. Approximately 80 percent of these women had advanced degrees. In other pilot studies (*12, 13*) a high proportional productivity of women's colleges with respect to attainment of the doctorate has been noted. But thus far there have been few data to suggest which among the other types of undergraduate institutions have been especially productive of women who attained the doctorate.

The Data Base

Sources of educational statistics on institutions and individuals present numerous difficulties. The items chosen for inclusion vary, as does the style of presentation; there are inconsistencies from one era to the next, and from one collecting agency to another.

Prior to 1917–18 very little information about baccalaureate degrees is available (*14*). From 1917–18 to 1937–38 the total number of baccalaureate and first professional degrees awarded by each institution to each sex is given for every second academic year in the *Biennial Survey of Education*, compiled by the Department of the Interior. During the early 1940's only very incomplete information was published (*5*). Since 1947–48 the total number of baccalaureate and first professional degrees awarded by each institution to each sex is given for each academic year in *Earned Degrees Conferred*, published by the Department of Health, Education, and Welfare (*15*). However, the separate identification of baccalaureate and first professional degrees from each institution was not accomplished until 1961–62. In the present study these data have been separated where necessary by means of a correction factor (*16*). Thus in addition to errors from reporting, recording, and retrieval, errors may arise from the approximations involved in the correction factor. The separation is necessary, however, to improve the comparability of the bases from which the doctorate population could be expected in the various colleges and universities. The lack of baccalaureate data prior to 1917 and the discontinuity between 1938 and 1947 have restricted the present calculations of percentage output to four decades—the 1920's, 1930's, 1950's, and 1960's.

By contrast, doctoral data are continuous and unambiguous. Since 1920 the Doctorate Records File has listed the number of doctorates received each year by sex, baccalaureate institution, year of baccalaureate, doctoral institution, and doctoral field. Errors arising from the use of these data are therefore restricted to those related to reporting, recording, or retrieval. The enumeration of baccalaureate recipients who later earned doctorates was accomplished by using data from the file from 1920 through 1973, the most recent year for which doctoral information was available at the time of the study. However, the baccalaureate years represented by this pop-

Table 1. Undergraduate institutions that ranked highest in number of graduates of each sex in the period 1910–1969 who obtained doctorates in the period 1920–1973.

Rank	Women		Men	
	Institution	Number	Institution	Number
1	Hunter College	1,110	University of California, Berkeley	6,619
2	University of California, Berkeley	926	University of Wisconsin	6,548
3	Barnard College	846	City College of New York	6,192
4	University of Wisconsin	808	University of Illinois	5,710
5	University of Michigan	773	Harvard University	5,465
6	Wellesley College	768	University of Michigan	4,703
7	University of Chicago	737	University of Minnesota	4,481
8	University of Minnesota	711	Massachusetts Institute of Technology	4,326
9	Brooklyn College	689	Cornell University	4,002
10	Radcliffe College	654	University of Chicago	3,671
11	New York University	651	University of California, Los Angeles	3,614
12	University of California, Los Angeles	642	Ohio State University	3,574
13	Smith College	638	Columbia University	3,559
14	Cornell University	622	New York University	3,266
15	Vassar College	597	Yale University	3,255
16	Mount Holyoke College	581	University of Texas	3,242
17	University of Illinois	577	Pennsylvania State University	3,189
18	University of Texas	570	Brooklyn College	3,042
19	Ohio State University	496	University of North Carolina	2,935
20	Bryn Mawr College	482	Purdue University	2,761
21	University of Florida	443	University of Washington	2,732
22	Stanford University	425	University of Missouri	2,720
23	Columbia University	423	Stanford University	2,610
24	University of North Carolina	408	University of Florida	2,594
25	Northwestern University	398	Princeton University	2,485
Number in ranked institutions		15,975		97,295
Number in 137 selected institutions		30,830		208,323
Number in all institutions		52,664		350,702

ulation extend over six decades, from 1910 through 1969 (*17*).

To complete the task, there remained the selection of institutions to be included in the study. There are at the present time approximately 1900 institutions in the United States which grant the baccalaureate degree, but only a small proportion have been considered important as sources of doctoral candidates (*8*). Provisionary calculations of percentage productivity were made on a substantial number of the 733 institutions reported in the Harmon and Soldz study of 1963 (*8*). In addition, a 5 percent random sample of all women doctorate recipients was available (*18*) which supplemented published information; and a review of several issues of *Earned Degrees Conferred* provided the names of institutions founded too recently to have been included in the Harmon and Soldz study. Institutions with large absolute numbers of graduates who had received doctorates, along with those appearing to have large percentages, constituted the list of 137 institutions selected for the present study.

For each of the 137 institutions, the number of baccalaureate recipients of each sex was obtained for each decade starting with 1920, and the number who subsequently attained doctorates, with the doctoral field of study, was recorded beginning with those whose baccalaureates dated to 1910. From these data the 25 highest-ranking institutions with respect to each of the following criteria for each sex were identified: (i) the number of graduates of the entire period (1910–1969) who attained doctoral degrees; (ii) the percentage of graduates (1920–1939 and 1950–1969 combined) who attained doctoral degrees; (iii) the number for each of the six decades; (iv) the percentage for each of the four decades; and (v) the total number; and (vi) the percentage for each of five broad doctoral fields of study. The tables thus developed are the bases for the results presented (*19*).

Table 2. Undergraduate institutions that ranked highest over four decades (1920–1939 and 1950–1969) in percentage of graduates of each sex who obtained doctorates. Only institutions with at least 400 graduates of the given sex during the 40 years have been ranked in the list for that sex.

Women			Men		
Institution	Number	Percent	Institution	Number	Percent
Massachusetts Institute of Technology	46	11.0	Reed College	583	29
Reed College	111	9.7	California Institute of Technology	1287	28
Swarthmore College	260	8.2	Harvey Mudd College	111	26
Bryn Mawr College	367	7.9	Swarthmore College	713	21
Radcliffe College	516	6.4	Oberlin College	1406	20
Barnard College	664	6.3	Antioch College	456	16
Antioch College	103	5.0	University of Chicago	2416	16
Brandeis University	112	4.6	Haverford College	525	16
Mount Holyoke College	452	4.3	Carleton College	567	15
Oberlin College	306	4.1	Massachusetts Institute of Technology	3737	15
Wellesley College	592	4.1	Pomona College	613	15
Cornell University	507	3.8	College of Wooster	551	14
Vassar College	451	3.8	Grinnell College	416	13
University of Chicago	446	3.6	Kalamazoo College	286	13
University of Florida	354	3.4	Rice University	876	13
Rice University	100	3.4	Brandeis University	285	12
Carleton College	103	3.1	Earlham College	287	12
University of North Carolina	289	3.1	Amherst College	901	11
Pomona College	116	3.1	Cornell University	3188	11
Stanford University	348	3.1	Harvard University	4156	11
Brown University	169	2.9	Hope College	401	11
Goucher College	186	2.8	Wabash College	406	11
Johns Hopkins University	44	2.6	Catholic University of America	630	10
University of Rochester	194	2.6	Depauw University	713	10
Smith College	458	2.5	Juniata College	237	10
			Park College	164	10

Table 3. Undergraduate institutions that ranked among the top 25 in total number for each of six decades (1910–1969) or in percentage for each of four decades (1920–1939, 1950–1969) of graduates of each sex who obtained doctorates.

Women	Men
Number	
Barnard College	University of California, Berkeley
University of California, Berkeley	City College of New York
Cornell University	Columbia University
Hunter College	Cornell University
University of Illinois	Harvard University
University of Michigan	University of Illinois
University of Minnesota	University of Michigan
Radcliffe College	University of Minnesota
Smith College	University of Missouri
University of Texas	Ohio State University
Vassar College	Pennsylvania State University
Wellesley College	University of Texas
University of Wisconsin	University of Wisconsin
	Yale University
Percentage	
Barnard College	Haverford College
Bryn Mawr College	Kalamazoo College
Cornell University	Oberlin College
Mount Holyoke College	Pomona College
Radcliffe College	Reed College
Reed College	College of Wooster
Vassar College	
Wellesley College	

The Most Productive Institutions

Table 1 shows the 25 undergraduate institutions that graduated in the period 1910–1969 the largest number of women who received doctorates between 1920 and 1973, and the comparable list for men. Also given are the total numbers of doctoral women and men from the 137 undergraduate institutions selected for this study and from all undergraduate institutions. Both for women and for men the top 25 institutions graduated about 30 percent of the individuals who went on to receive doctorates. The 137 institutions graduated about 60 percent although they constitute some 7 percent of the number of baccalaureate institutions. In the period 1920–1973 women received 13 percent of the doctorates.

Ten public and five private universities

appear on both lists, but one of the former, the University of North Carolina, maintained a separate campus for women students until 1964 and is properly counted as a women's college. Eight of the ten remaining institutions on the list for women, for essentially all the baccalaureate years encompassed by the study, admitted women only (*20*). There are no private coeducational colleges on the list for women, and all institutions on the list for men are universities or large public colleges. Thus, except for the women's colleges, all the institutions that appear on these lists enrolled relatively large numbers of students. Hence their standing in terms of absolute numbers of graduates in the ranks of doctoral recipients could result from size alone.

A more pertinent assessment of productivity, therefore, may be gained by determining the percentage of graduates who achieved doctorates. The highest ranking institutions by this criterion are shown in Table 2. Women's colleges and private universities dominate the list for women. By contrast, it is striking that the list for men includes 14 relatively small, private, coeducational colleges, none of which appears in Table 1.

Twelve institutions, eight that admitted women only and four universities, appear in the top 25 with respect both to the number and to the percentage of their women graduates who subsequently obtained doctorates. Four institutions are common to the two men's lists, all of them private universities. The University of Chicago and Cornell University are the only institutions that ranked high for both women and men in both numerical and percentage outputs. A few coeducational colleges appear on both the women's and the men's lists in Table 2, but their enrollment of either sex was sufficiently small that they do not appear in Table 1. It should be noted that coeducational colleges, which appear less frequently on the women's list of percentages than do the women's colleges, are approximately five times as numerous (*5, 15*). The total number of private universities is about equal to that of the women's colleges, but there are only three such institutions on both lists for women and therefore this institutional type also has small relative representa-

Table 4. Within doctoral fields, undergraduate institutions that ranked highest in number of women graduates in 1910–1969 who obtained doctorates in 1920–1973.

Rank	Physical sciences and engineering	Life sciences	Social sciences	Arts and humanities	Education
1	Mount Holyoke College*	Cornell University*	Brooklyn College*	Barnard College*	Hunter College*
2	Barnard College*	University of California, Berkeley	Hunter College	Wellesley College*	University of Wisconsin*
3	Hunter College	Mount Holyoke College*	University of California, Berkeley	Hunter College	New York University*
4	University of California, Berkeley	Hunter College	Barnard College*	Smith College*	University of Minnesota
5	Vassar College*	University of Wisconsin	University of Chicago*	Radcliffe College*	Columbia University*
6	University of Michigan	Wellesley College*	University of Michigan	Bryn Mawr College*	University of Florida*
7	University of Chicago*	University of Michigan	Wellesley College*	Vassar College*	University of California, Berkeley
8	Wellesley College*	University of Chicago*	Radcliffe College*	University of California, Berkeley	University of California, Los Angeles
9	Cornell University*	Barnard College*	New York University	University of Chicago*	University of Michigan
10	Bryn Mawr College*	University of Illinois	University of Minnesota	University of Wisconsin	Boston University
11	Radcliffe College*	Smith College	University of California, Los Angeles	University of Michigan	Ohio State University
12	University of Illinois	University of Texas	Cornell University*	Mount Holyoke College*	University of North Carolina*
13	Smith College	Vassar College*	Vassar College*	University of California, Los Angeles	University of Illinois
14	Brooklyn College	University of Minnesota	University of Wisconsin	University of Texas	Brooklyn College
15	University of California, Los Angeles	Radcliffe College*	Stanford University*	University of Minnesota	University of Texas
16	New York University	Brooklyn College	Smith College*	Brooklyn College	Wayne State University
17	University of Texas	University of California, Los Angeles	Ohio State University	Stanford University*	University of Chicago*
18	University of Wisconsin	Oberlin College*	City College of New York*	New York University	University of Nebraska
19	Swarthmore College*	Goucher College*	University of Illinois	University of Illinois	University of Pittsburgh*
20	Goucher College*	University of Washington	Oberlin College*	Oberlin College*	Indiana University
21	University of Minnesota	Rutgers University	University of Texas	University of Pennsylvania*	University of Missouri
22	Massachusetts Institute of Technology*	University of North Carolina	Northwestern University	Cornell University	State University of Iowa
23	Northwestern University	Ohio State University	Swarthmore College*	Northwestern University	Northwestern University
24	Rutgers University	Bryn Mawr College*	University of Florida*	Swarthmore College*	University of Pennsylvania
25	Ohio State University	†	Bryn Mawr College*	University of North Carolina*	University of Washington
			Number in ranked institutions		
	1,484	2,575	3,948	4,422	3,878
			Number in 137 selected institutions		
	2,665	4,990	6,861	7,596	7,256
			Number in all institutions		
	4,168	7,826	10,008	13,038	15,462

*Also among top 25 for percent productivity by field. †More than one institution has the same number.

tion. Thus the relative frequency of appearance of women's colleges on these lists calls special attention to how important this institutional type has been as a source of women doctorate recipients.

Institutional productivity by any measure may vary with time, some institutions having been highly productive during certain periods but not others. Table 3 lists in alphabetical order the institutions that were consistently productive throughout the time observed, having ranked among the top 25 for each of the six or four decades, respectively. There are four women's colleges and one private university with long and continuous histories of graduating both large numbers and large percentages of women who have subsequently earned doctorates. The lists for men have quite a different character: the division between large universities for total output and small, private, coeducational colleges for percentage output is clearly evident. No institution appears on both lists for men.

Table 4 shows the ranking of baccalaureate institutions in five fields of learning with respect to numbers of women graduates who earned doctorates. Table 5 gives comparable information concerning men. In each of four fields the 137 institutions produced more than 58 percent of both women and men who subsequently received doctorates; in the fifth, education, they produced 47 and 42 percent respectively. Women's colleges and large public universities appear most frequently for women, the former in all fields except education, the latter in all fields. A similar pattern is not observed for men. The men's colleges number from one to four per field. In all fields it is the large public universities, many of which appear in Table 1, that occur with greatest frequency in the men's lists, a

Table 5. Within doctoral fields, undergraduate institutions that ranked highest in number of men graduates in 1910–1969 who obtained doctorates in 1920–1973.

Rank	Physical sciences and engineering	Life sciences	Social sciences	Arts and humanities	Education
1	Massachusetts Institute of Technology*	University of Wisconsin*	City College of New York*	Harvard University*	University of Wisconsin*
2	University of California, Berkeley	University of California, Berkeley	Harvard University*	Yale University*	City College of New York
3	University of Illinois	University of Illinois	University of California, Berkeley	Columbia University	New York University
4	City College of New York	University of Minnesota	University of Wisconsin	University of California, Berkeley	University of Minnesota
5	University of Michigan	Cornell University*	University of Chicago*	Princeton University*	University of Florida*
6	University of Wisconsin	Ohio State University	Brooklyn College*	University of Wisconsin	University of North Carolina*
7	Harvard University	Pennsylvania State University	University of California, Los Angeles	University of Michigan	Ohio State University
8	Cornell University*	Iowa State University*	University of Michigan	City College of New York	University of Illinois
9	Purdue University	Michigan State University	University of Illinois	University of Chicago*	University of California, Berkeley
10	University of Texas	Purdue University	University of Minnesota	University of California, Los Angeles	Brigham Young University*
11	California Institute of Technology*	City College of New York	New York University	Stanford University	University of Nebraska*
12	University of Minnesota	University of Michigan	Columbia University	University of Minnesota	University of California, Los Angeles
13	Rensselaer Polytechnic Institute*	Rutgers University	Cornell University	Brooklyn College	Pennsylvania State University
14	University of Chicago*	University of Missouri	Ohio State University	University of Texas	Indiana University
15	Pennsylvania State University	Oklahoma State University	Yale University	New York University	Wayne State University*
16	Columbia University	Utah State University	University of Texas	University of Illinois	University of Michigan
17	University of California, Los Angeles	University of Nebraska	Stanford University	Oberlin College*	University of Missouri
18	Carnegie-Mellon Institute*	Harvard University	University of Washington	University of North Carolina	University of Utah*
19	Yale University	University of Chicago*	University of Florida	Dartmouth College	Michigan State University
20	Ohio State University	University of North Carolina*	Pennsylvania State University	University of Pennsylvania	Columbia University
21	Iowa State University	University of Massachusetts*	University of Pennsylvania	University of Washington	State College of Iowa*
22	University of Washington	University of Maryland	Northwestern University	Northwestern University	Brooklyn College
23	Case-Western Reserve University*	University of Florida	State University of Iowa	Cornell University	North Texas State University*
24	Stanford University	Oregon State University	University of Missouri	Amherst College*	Temple University*
25	Princeton University	University of Washington	Oberlin College*	State University of Iowa	Boston University
			Number in ranked institutions		
	38,322	18,163	17,396	14,909	12,549
			Number in 137 selected institutions		
	73,116	34,829	34,523	28,791	26,059
			Number in all institutions		
	113,475	57,347	54,744	48,738	62,018

*Also among top 25 for percent productivity by field.

few scientific and technological institutions being added in physical sciences and engineering. Institutions marked with an asterisk also rank among the top 25 with respect to percentage output for each field. For women, the women's colleges predominate among these doubly productive institutions in four of the five fields; for men, private universities are the most frequent institutional type in three of the five, and large public universities in two.

The use of single-sex institutions by students to study in fields traditionally associated with the other sex has been documented previously in a study by Newcomer (*21*). In a selected group of 14 institutions she found that 7 percent of men undergraduates in the coeducational institutions majored in arts and humanities but 19 percent in the all-male institutions did so; and 10 percent of the women undergraduates in coeducational schools chose the natural sciences compared with 19 percent of the women in the women's colleges. The present study confirms and extends these findings. Twelve of the 25 institutions with the highest percentages of men who subsequently received doctorates in the arts and humanities are men's institutions; nine of the 24 institutions with the highest percentages of women who subsequently received doctorates in the physical sciences and engineering are women's colleges. Eight of the women's colleges were also highly productive in sex-traditional fields, but only one of the men's colleges was so. Instead, for men, the private, liberal arts, coeducational college was the most frequently represented type of institution in terms of percentage productivity in the social sciences and education as well as in the natural sciences.

The majority of institutions that have been highly productive of women doctoral recipients have been so in each of several fields, as is shown in Table 6. That is, institutions that offer strong preparation in more than one field are more likely to graduate women who proceed to the doctorate than are those strong in only one field. By contrast, 77 percent of the institutions listed for men contributed their graduates to only a single doctoral field. These data suggest that the identification of an institution with a particular specialty has been less useful to women of doctoral potential in their college selection than it has been for men. Douvan and Adelson have shown that, in general, a woman's career identity emerges later in life than does a man's (*22*); hence institutions that offer strengths in several fields would be more likely to provide women with the opportunity to develop a disciplinary identification after having started college without penalty for the delay. The data suggest, however, that women who took doctorates in education were the most likely to have identified themselves with their future area of study by the time they entered college: more than half the institutions listed for only one field appear by virtue of their productivity in the field of education.

Summary and Conclusions

Several studies of institutional productivity with respect to baccalaureate recipients who have attained doctorates have been published (*8–10*). However, since the number and percentage of women doctorate recipients are small, these studies reveal essentially only those institutions that have been important sources of men doctorate recipients. The tasks involved in separating sex-aggregated data are considerable but must be undertaken in order to identify those institutions that have been especially productive of women. Only when this has been accomplished is it possible to compare the patterns of institutional participation in the baccalaureate preparation of women and men doctoral degree recipients.

Analysis of the data developed indicates that more of the institutions ranked high for women on the aggregated lists (Tables 1 and 2) appear also on the lists by decade (Table 3) and by field (Tables 4 and 6) than is the case for institutions on the aggregated lists for men. The repeated appearance of the same institutions for women, along with the more diffuse pattern for men, leads to the conclusion that there has been a narrower range of institutions that have been supportive of the predoctoral preparation of women than is true for men. In particular, nine institutions, seven private women's colleges and two private universities (*23*), stand out as major contributors of women, only two of which

Table 6. Number of doctoral fields in which institutions ranked among the top 25 in both number (1910–1969) and percentage (1920–1939, 1950–1969) of graduates of either sex who obtained doctorates.

Women	Men
Five of the five fields	
University of Chicago	None
Four of the five fields	
Barnard College	University of Chicago
Bryn Mawr College	
Radcliffe College	
Vassar College	
Wellesley College	
Three of the five fields	
Cornell University	None
Mount Holyoke College	
Oberlin College	
Swarthmore College	
Two of the five fields	
University of Florida	Cornell University
Goucher College	Harvard University
University of North Carolina	University of North Carolina
Smith College	Oberlin College
Stanford University	University of Wisconsin
One of the five fields	
Brooklyn College	Amherst College
City College of New York	Brigham Young University
Columbia University	Brooklyn College
Hunter College	California Institute of Technology
Massachusetts Institute of Technology	Carnegie-Mellon University
New York University	Case-Western Reserve University
University of Pennsylvania	City College of New York
University of Pittsburgh	University of Florida
University of Wisconsin	State College of Iowa
	Iowa State University
	Massachusetts Institute of Technology
	University of Massachusetts
	University of Nebraska
	Princeton University
	Rensselaer Polytechnic Institute
	Temple University
	North Texas State University
	University of Utah
	Wayne State University
	Yale University

could be expected to be revealed in studies of total output of women and men combined. The majority of institutions ranked high for men, either in total output (principally large universities) or in percentage output (principally small, private, coeducational colleges), do not appear on the comparable lists for women. It may therefore be concluded that there are distinct differences in the baccalaureate origins of women and men who have earned doctorates.

In an attempt to identify characteristics that distinguish the institutions which are more productive of women from those chiefly productive of men, the following general observations emerge from the data developed for this study. Women who subsequently received doctorates were more likely to have graduated from institutions that enrolled large numbers of women students, had a long and continuous history of women graduates who attained doctorates, and offered strong academic preparation in several areas of study. Consistent with these observations is the suggestion that a favorable climate for women students who are intellectually motivated and capable is one that conveys to them a sense of being in an environment where there are many other women seriously involved in a variety of academic pursuits. The characteristics that distinguish highly productive institutions for men from those chiefly productive for women are also of interest. Men who subsequently received doctorates were more likely to have graduated from institutions that had a high proportion of men students and exhibited a strongly defined focus on a relatively narrow range of academic interests. Consistent with these observations is the suggestion that a favorable climate for men students who are intellectually motivated and capable is one that conveys to them a sense of being in a predominantly male environment dedicated to the field with which they have identified themselves.

References and Notes

1. In older studies of doctoral production in which data on women and men were aggregated, the principal undergraduate sources of women with doctorates are likely to have been obscured because of the small number and percentage of women who have received doctorates. In order to appreciate differentials in the institutional support of women and men it is therefore necessary to utilize sex-separated data. See, for example, M. E. Tidball, *J. Higher Educ.* **47**, 373 (July–August 1976), in which this point is supported by analysis of attitudinal data from the American Council on Education's survey of teaching faculty.
2. The term "research doctorate" refers to degrees which require a research component for their attainment (Ph.D., Ed.D., and so forth) as distinct from advanced doctoral degrees in course, such as the M.D. and J.D. For simplicity, the term "doctorate" will be used hereinafter instead of "research doctorate."
3. W. Goodsell, Ed., *Pioneers of Women's Education in the United States* (McGraw-Hill, New York, 1931).
4. F. Rudolph, *The American College and University, A History* (Knopf, New York, 1962), p. 322.
5. Department of the Interior, *Biennial Survey of Education* (Government Printing Office, Washington, D.C., 1918–1947). For 1917–18 through 1930–31 information on the combined number of baccalaureate and first professional degrees by sex, by broad field, and by institution is available for every second academic year. For 1930–31 through 1937–38 this information is available only by sex and institution. For 1939–40 and 1941–42 it is available only for land grant institutions.
6. M. W. Rossiter, *Am. Sci.* **62**, 312 (1974).
7. The Doctorate Records File is a continuously updated, computer-accessible record of responses to annual questionnaires to new doctoral recipients. It is maintained by the Commission on Human Resources of the National Research Council–National Academy of Sciences.
8. L. R. Harmon and H. Soldz, *Doctorate Production in United States Universities 1920–62*, NAS–NRC Publ. No. 1142 (1963).
9. Office of the Vice Chancellor for Budget and Planning, City University of New York, *Number of Doctorates by Institution of Baccalaureate by Field of Study, 1920–70 and 1965–70*. (City University of New York, New York, 1971).
10. K. R. Hardy, *Science* **185**, 497 (1974). The formula supplied there for calculating productivity is inappropriate for use with single-sex institutions. That is also the case with the revised formula [*ibid.* **188**, 311 (1975)].
11. M. E. Tidball, *Educ. Rec.* **54**, 130 (1973).
12. ———, *Change* **6**, 51 (1974).
13. Carnegie Commission on Higher Education, *Opportunities for Women in Higher Education* (McGraw-Hill, New York, 1973), p. 72.
14. *Annual Report of the Commissioner of Education, Department of the Interior* (Government Printing Office, Washington, D.C., 1900–1918). Published 1899–1900 through 1915–16, but only occasionally contains baccalaureate information by sex and by institution.
15. Office of Education, Department of Health, Education, and Welfare. *Earned Degrees Conferred* (Government Printing Office, Washington, D.C., 1948–1970). For 1947–48 through 1960–61 information on the combined number of baccalaureate and first professional degrees by sex, by field, and by institution is available for every academic year. For 1961–62 through the present this information is presented separately for baccalaureate and four-or-more-year first professional degrees. The baccalaureate data for Barnard College were obtained directly from Barnard, Office of the Registrar, since in many years they were published only in combination with those of Columbia University in the sources used.
16. First professional degrees as defined in the sources used include degrees in medicine and law and a number of other degrees requiring five or more years of higher education, as well as 4-year first professional degrees mainly in the sciences and engineering. Since recipients of the former do not contribute substantially to the pool of individuals who subsequently receive a research doctorate, it was necessary for the percentage calculations to correct the data for those years when baccalaureate and first professional degrees were combined in the listings. Individuals earning 4-year first professional degrees from the institutions in question do constitute a group from which doctoral candidates are drawn and they were therefore included with the baccalaureate degrees for the purposes of this study. It should be noted that Hardy (*10*) did not make this separation in his calculations; that accounts in part for the discrepancy between his findings and the ones reported here.

    Correction factors for five-or-more-year first professional degrees were calculated for all institutions from the data on baccalaureate and first professional degrees awarded by field. The factors, f, are defined by the equation $f = (N_T - N_F)/N_T$, where N_F is the number of five-or-more-year first professional degrees and N_T is the total number of baccalaureate and all first professional degrees. For the period 1961–62 to the present, information was given separately for the five-or-more-year degrees; hence the corrections, affecting only 1960–61, are small for the decade 1960–69. The separated data could also be used to verify that correction factors calculated for that decade were accurate within 5 percent. It is believed that the correction factors calculated by the same procedure for the decade 1950–59 have a similar accuracy. The correction factors for 1920–29 were calculated from a different categorization of data by field, and no direct estimate of accuracy is possible. For the decade 1930–39 data were not available to calculate corrections and those of 1920–29 were used. Comparison with undergraduate enrollment data and with the factors for 1950–59 indicated that this procedure gave a consistent pattern of results. For women the correction factor varied from $f = 0.62$ to $f = 1.00$ and approximately 25 percent of the institutions had $f < 0.95$. For men the factor varied from $f = 0.28$ to $f = 1.00$ and approximately 50 percent of the institutions had $f < 0.95$. The percentage, P, of baccalaureate degree recipients who continued to the doctorate is defined by the equation $P = 100\, N_D/fN_T$, where N_D is the number of individuals from a given baccalaureate institution subsequently receiving a doctorate and f and N_T are as defined above. Therefore, the uncertainty in P depends on the uncertainty in f, as well as the statistical uncertainties inherent in the absolute size of N_D.
17. Utilization of baccalaureate year rather than doctoral year permits comparisons between women and men to be made directly without the assignment of arbitrary and different rates of doctoral attainment for each sex.
18. These data have been provided to one of us (M.E.T.) by the Commission on Human Resources, for ongoing studies on undergraduate sources of women with doctorates.
19. Tables not included in their entirety in this paper may be obtained by written request to Dr. M. E. Tidball, Department of Physiology, The George Washington University Medical Center, 2300 Eye Street, NW, Washington, D.C. 20037.
20. Hunter College first admitted men to its Bronx campus (now Lehman College) in 1950 and to its Park Avenue campus in 1964.
21. M. Newcomer, *A Century of Higher Education for Women* (Harper, New York, 1959), p. 95.
22. E. Douvan and J. Adelson, *The Adolescent Experience* (Wiley, New York, 1966), chap. 7.
23. The nine institutions are Barnard College, Bryn Mawr College, University of Chicago, Cornell University, Mount Holyoke College, Radcliffe College, Smith College, Vassar College, and Wellesley College.

24. We thank the Commission on Human Resources of the National Research Council–National Academy of Sciences for providing us with the programming, computer time, and access to the Doctorate Records File which made this article possible, as well as the support provided to one of us (M.E.T.) during a sabbatical leave at the commission in 1974–75. We also thank Charles S. Tidball for reviewing and evaluating the manuscript, and Patricia T. Foley and Carolyn J. Wells, who assisted in compiling the baccalaureate data. One of us (V.K.) acknowledges a fellowship which partially supported this study from the Project on Women and Career Options supported by a Carnegie Corporation grant administered by the University of Massachusetts.

APPENDIX E

E-1 "Disparity in Rank, Grade, and Salary Between Women and Men GS Employees at NIH and NINCDS," by Rosalind B. Marimont, May 1977.

E-2 "Statistics on Sex Discrimination -- NIH: 1971-1979

APPENDIX E-1

DISPARITY IN RANK, GRADE, AND SALARY BETWEEN WOMEN AND MEN GS EMPLOYEES AT NIH AND IN NINCDS

Rosalind B. Marimont

This is a study of disparity in rank, grade, and salary between women and men general schedule (GS) employees of the National Institutes of Health (NIH), and of one of the institutes - the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS).

This study evaluates four measures of the relative status of men and women. They are:

1. Composition of the top level management positions - NIH and Institute Directors, Deputies, Associate and Assistant Directors.
2. Composition of the highest paid staff - the super-grades, GS-16 and above, and the special ranking 208(g) positions.2/
3. Senior professional staff, GS-13 and above, and the distribution of men and women in those grade levels.

2/ 42 U.S.C. 210(g) (originally 208(g) authorizes the Secretary of HEW to appoint within the Public Health Service not more than 150 positions of which not less than 115 shall be for NIH in the professional, scientific, and executive service at a pay not less than that of GS-16 without CSC competitive examinations. The occupants of those positions will be referred to hereafter as "208(g)'s".

May, 1977

4. All staff - median GS grades and corresponding salaries. (There are 10 steps per grade, but salaries are computed as the 4th step of each grade, as the median step).

These measures were evaluated for several population groups. They are:

1. Total NIH GS staff
2. NIH Scientific and Professional Staff
3. NIH Intramural Staff, comparing menand women of equal educational levels
4. NINDS GS staff
5. NINDS Scientific and Professional staff (1974)
6. NINDS Intramural staff, comparing men and women of equal educational level.

Except as noted, these statistics are for June, 1972 from official records of NIH, principally the EEO Quarterly Reports issued by the NIH-EEO Office and the Systems and Action Reports of the Systems and Actions Branch of the Division of Personnel Management of NIH.

Two types of charts are presented.

1. Percentages by sex within six major GS grade groupings - GS 16 and above, GS 14-15, GS 12-13, GS 9-11, GS 5-8, and GS 1-4. These will be called the aggregate charts.
2. Numbers, percentages, medians, and distributions for each of the 18 GS levels. These will be called the detailed charts.

A. NIH TOTAL GS-STAFF

Figure 1 (attached) is the aggregate chart and Figure 2 (attached) the detailed chart for this group.

1. Top Level NIH Management

The top level of NIH consists of the Director, NIH, his Deputy, and Associate and Assistant Directors. At the top of each Bureau, Institute, Division, and Office (abbreviated B/I/D/O) is its Director, Deputy, Associate, and Assistant Directors. They consist of:

	Men	Women
NIH Director, Deputy, etc.	12	0
B/I/D/O Directors	18	0
B/I/D/O Deputy Directors, Assoc. etc	74	2
Total	104	2

2. Supergrades

There are 189 supergrade positions consisting of:

GS-16, GS-17, 208-gs	186	3

3. Senior Professional staff

(GS-13 and over)

Percentage of employees in senior positions	36.3%	4.8%

4. All employees

	Men	Women	Deficit for Women
Number of employees	3,937	5,599	
Median GS grade	GS-11.4	GS-6.6	GS-4.8
Salary of median grade	$15,760	$9,620	$6,140

Summary

Women earn only 61% as much as men.

A man has 7 times the chance of a woman to hold a senior professional job

B. NIH SCIENTIFIC AND PROFESSIONAL STAFF

Figure 3 is the aggregate chart and Figure 4 the detailed chart for this group. It is often argued that the disparities shown in No. 4 of the preceding section (all employees) can be attributed to the presence of large numbers of women in clerical and secretarial low paid jobs. For this reason we now compare only scientists to eliminate this factor.

1. Top level management - (same as for NIH overall)

	Men	Women
NIH and B/I/D/O Directors, etc.	104	2

2. Supergrades

There are 174 supergrade positions

	Men	Women
GS 16 and over including 208-gs	172	2

3. Senior Professional Staff

	Men	Women
Percentage holding GS-13 and over	66.1%	13.7%

4. All Scientists

	Men	Women	Deficit for Women
Total Numbers	1,344	1,025	
Median GS grade	14.07	9.68	4.39
Median salary	$24,430	$12,980	$11,450

Summary

A woman scientist earns only 53% as much as a male scientist.

A male scientist's chance of holding a senior position is 5 times that of a woman scientist.

In both absolute and relative terms, the salary deficit of woman scientists is worse than that of the general population of women at NIH.

In fact, the median salary for women scientists, all of whom have at least a bachelor's degree, is less than that of the average man at NIH, many of whom have no academic degrees (e.g., messengers, mail clerks, animal caretakers, etc.)

C. INTRAMURAL STAFF-COMPARISON BY EDUCATIONAL LEVEL

It is further argued that the disparity shown above can be attributed to more education, in particular, more doctorate degrees held by men. The unwritten requirement for doctorate degrees to advance to senior positions is in itself a questionable practice, not required by the Civil Service Commission, and is often attacked as de facto discrimination against women, who because of discrimination in admissions and fellowships, are less likely to have higher degrees. However, we will show disparities even when men and women are compared by educational level. Source of data is an NIH computer printout of the Intramural staff, August 29, 1972.

The staff was divided into four groups, according to the highest academic degree. Since the range of grades differed for the four groups, we will use as the dividing line for the upper range not the GS-13, but the approximate top quartile grade for each group (i.e., the grade which is held or exceeded by 25% of the group.)

The four groups are as follows:

Group	Highest Degree	Numbers Men	Numbers Women	Women as % of total	Top Quartile Grade	Top Quartile Salary
I	None	598	835	58%	GS-08	$11,015
II	BA, BS	271	407	60%	GS-11	$14,641
III	MA, MS	84	120	59%	GS-13	$20,612
IV	PhD, MD	479	66	12%	GS-16	$32,645

Median grade, salary, deficits, and top quartile membership are shown as follows:

Group	Median Grade Men	Women	Def.	Median Salary Men	Women	Diff.	Women's Salary as %of Men's	% holding top quartile grade or Higher	
I	7.62	6.18	1.44	$10,580	$ 9,140	$1,440	86%	42.6%	13.5%
II	9.63	9.30	.33	$12,900	$12,500	$ 400	97%	36.9%	18.9%
III	11.75	9.95	1.8	$16,600	$13,300	$3,300	80%	27.4%	18.3%
IV	14.83	13.56	1.27	$27,400	$22,500	$4,900	82%	21.1%	1.5%

Thus the disparity persists even if the comparison is by educational level, not only in median earnings, but even more in the attainment of upper level jobs in each group.

(a) For those with no academic degree, a man has three times the chance of a woman of being in a top quartile grade (42.6% to 13.5%)

(b) For those with a bachelor's degree, a man has two times the chance of a woman of being in a top quartile grade (36.9% to 18.9%)

(c) For those with a master's degree, a man has 1.5 times the chance of a woman of being in a top quartile grade (27.4% to 18.3%)

(d) For those with a doctor's degree, a man has 14 times the chance of a woman of being in a top quartile grade.

Figures 5 and 6 show the aggregate and detailed charts for Group I. As in all other charts, the percentage of women decreases as the GS grade increases. Women comprise 58% of Group I, but they hold approximately 68% of the jobs in the lowest two groupings, and only 31% and 8% in the highest two. The pattern of relegating women to the lower paid jobs, is as true for the group I population, which holds the lowest jobs, as it is for the PhD's who hold the highest.

E-1

D. NINDS GS STAFF

Figures 7 and 8 (attached) show the aggregate and detailed charts for the NINDS GS staff.

1. Top Level

The top posts in NINDS are the Institute Director, his Deputy, and Program and Office Directors, and on the next level, the Laboratory and Branch Chiefs.

	Men	Women
Institute Director, Deputy, etc.	6	0
Laboratory and Branch Chiefs	21	0
Total	27	0

2. Supergrades

There are 19 supergrades in NINDS

	Men	Women
GS-16, GS-17, 208-g	19	0

3. Senior Professional Staff

Percentage of employees holding GS-13 or more	50%	6.2%

4. All employeees

	Men	Women	Deficit
Number (total)	197	251	
Median grade	13	7.51	5.49
Median salary	$20,610	$10,480	$10,130

Summary

The median women's salary is only 51% of the median man's. A man has 8 times the chance of a woman of holding a senior job.

E. NINDS SCIENTIFIC AND PROFESSIONAL STAFF (1974)

Figure 9 shows the detailed chart for the NINDS Scientific and Professional staff for November 30, 1974. We shall see that the disparity between men and women scientists is greater than that between all men and women.

1. Top Level Management

	Men	Women
Same as for NINDS overall	27	0

2. Supergrades

GS-16, GS-17, 208-g	18	0

3. Senior professional staff

Percentage holding GS-13 or higher	79%	20%

4. All Scientists

	Men	Women	Deficit for women
Number	91	50	
Median grade	14.7	9.7	5
Median salary	$26,900	$13,000	$13,900

Summary

The median woman scientist's salary is only 48% as much as a man scientist's. A man scientist has 4 times the chance of a woman scientist of holding a senior job.

F. NINDS INTRAMURAL STAFF (BY EDUCATIONAL LEVEL)

The division into groups was the same as for the NIH overall education study. Top quartile grade and salary are the same as for NIH. Group composition is as follows:

Group	Highest Degree	Numbers Men	Women	Women as % of total
I	None	30	46	60%
II	BA, BS	8	17	65%
III	MA, MS	4	4	50%
IV	PhD, MD	40	5	11%

The statistics for the groups are:

Group	Median Grade Men	Women	Diff	Median Salary Men	Women	Diff	W. Sal as % of men's	% holding top quartile or higher Men	Women
I	9.0	6.12	2.88	$12,150	$9,070	$3,080	75%	50%	8.7%
II	11.0	9.25	1.75	$14,640	$12,400	$2,240	85%	50%	24%
III	12.5	9.5	3	$19,000	$12,750	$6,250	67%	25%	0
IV	15.25	13.25	2	$29,200	$21,450	$7,750	73%	28%	0

Summary

In each group women earn less than men, and their chance to be in the top level jobs ranges from 0 at worst, to less than half that of a man, at best.

G. PROMOTIONS, HIRING, AND AFFIRMATIVE ACTION

The detailed grade structure analysed so far, and a comparison with the structure four years later (June, 1976) may be used to show the nature of promotion policy. Referring to Fig. 1, we see that women comprise 30% of the GS 12-13 group. Since this group is the major pool for the GS 14-15 group, if men and women in the GS 12-13 group had equal chances to be promoted, the GS 14-15 group would also have 30% women. Instead, it has only 14.4% women. A woman has only half the chance of being promoted from GS 12-13 to the GS 14-15 group. Promotion into the supergrades is even more biased; the percentage of women decreases from 14.4% to 1.6%, a factor of about 9. Every chart shows this same effect- a decrease in percentage of women as the GS level increases.

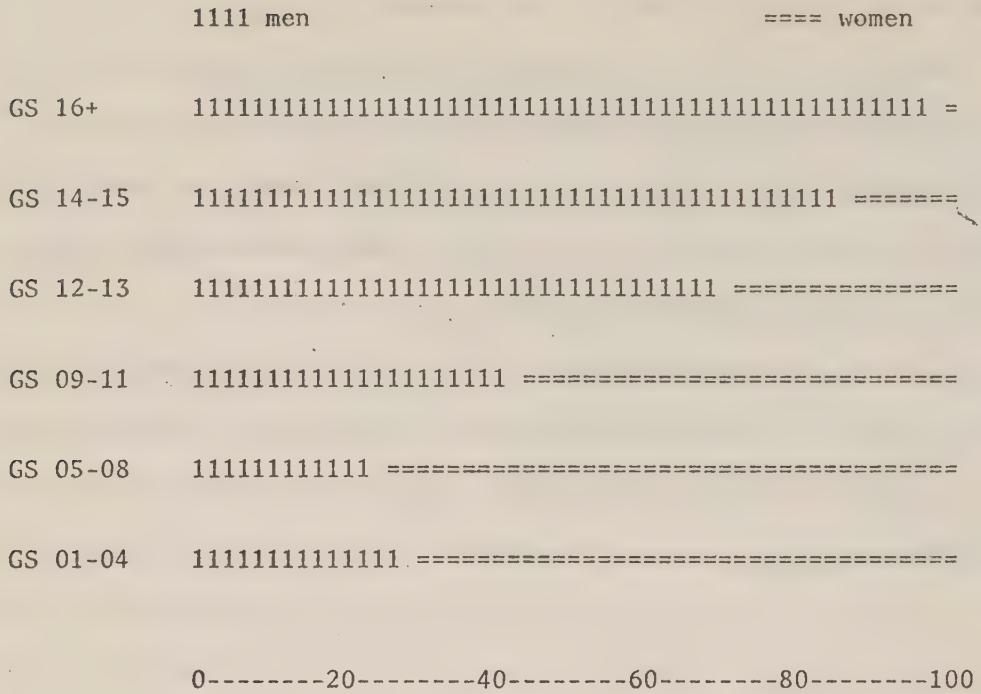
If this policy had changed in recent years, these distributions would be different now. Figure 10, comparing 1976 with 1972, shows only minute differences. The greatest improvement, in GS-16 and above, has been at the rate of less than 1% per year. At this rate, it would take 62 years for women to attain a fair share of the top jobs! The median wage for women in 1976 was 62% of that for men, and her chance of a senior job only one seventh that of a man- virtually unchanged from the 61% and one seventh in 1972.

Figures 11 and 12 show the aggregate and detailed charts for NIH, June 1976. Note, for example, from Fig. 2 and 10, that women comprised 16.3% of the senior staff in 1972, and 17.3% in 1976. Turnover rate is approximately 15% per year, so that in these four years about 60% of the jobs changed hands, yet only 1% changed from male to female hands.

In 1972, of 212 promotions to GS-13 or higher, only 40, or 19% went to women. In 1970 and 1971, of 116 senior promotions approved by the Scientific Directors, only 9, or about 8% went to women.

NIH GS Grade Personnel, June 1972
Percentage Distribution within Major Groupings
each symbol = 2% of employees

E-1



Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
GS 16+	189	186	3	1.6	4.7	0.1
GS 14-15	905	775	130	14.4	24.4	2.4
GS 12-13	1189	835	354	29.8	45.6	8.7
GS 09-11	1831	771	1060	57.9	65.2	27.6
GS 05-08	3604	853	2751	76.3	86.9	76.8
GS 01-04	1818	517	1301	71.6	100.0	100.0

Percentage of employees having specified grade or higher

Source: EEO Quarterly Report, June 1972

Grade 208-g included in GS 16+.

Figure 1

NIH GS Personnel
Grade Distribution by Sex, June 1972
(each symbol represents 25 employees)

E-1

	Men	Women
208-g	1111	
GS-17	1	
GS-16	111	
GS-15	1111111111111	=
GS-14	111111111111111111	===
GS-13	111111111111111111	=====
GS-12	111111111111111	========
GS-11	111111111111	============
GS-10	1	
GS-09	111111111111111111	============================
GS-08	11	====
GS-07	11111111111111	==================================
GS-06	1111111	=========================
GS-05	111111111111	==
GS-04	111111111111	============================
GS-03	11111	=============
GS-02	11	======
GS-01	1	===

Median Grade 11.41 6.61 Median difference= 4.8

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
208-g	88	88	0	0.0	2.2	0.0
GS-17	13	13	0	0.0	2.6	0.0
GS-16	88	85	3	3.4	4.7	0.1
GS-15	372	336	36	9.7	13.3	0.7
GS-14	533	439	94	17.6	24.4	2.4
GS-13	614	468	146	23.8	36.3	5.0
GS-12	575	367	208	36.2	45.6	8.7
GS-11	618	297	321	51.9	53.2	14.4
GS-10	49	32	17	34.7	54.0	14.7
GS-09	1164	442	722	62.0	65.2	27.6
GS-08	160	39	121	75.6	66.2	29.8
GS-07	1223	343	880	72.0	74.9	45.5
GS-06	824	165	659	80.0	79.1	57.3
GS-05	1397	306	1091	78.1	86.9	76.8
GS-04	1001	293	708	70.7	94.3	89.4
GS-03	478	136	342	71.5	97.8	95.5
GS-02	235	61	174	74.0	99.3	98.6
GS-01	104	27	77	74.0	100.0	100.0
Total	9536	3937	5599	58.7		
Senior*	1708	1429	279	16.3		

Percentage of employees having specified grade or higher
* Grades GS-13 or higher
Source: EEO Quarterly Report, June 1972

Figure 2

E-1

NIH Scientific and Professional Personnel, June 1972
Percentage Distribution Within Major Groupings
each symbol = 2% of employees

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
GS 16+	174	172	2	1.1	12.8	0.2
GS 14-15	596	520	76	12.8	51.5	7.6
GS 12-13	489	342	147	30.1	76.9	22.0
GS 09-11	778	228	550	70.7	93.9	75.6
GS 05-08	328	81	247	75.3	99.9	99.7
GS 01-04	4	1	3	75.0	100.0	100.0

Percentage of employees having specified grade or higher
Source: Systems and Actions Report, June 1972

Figure 3

NIH Scientific and Professional GS Personnel
Grade Distribution by Sex, June 1972
(each symbol represents 15 employees)

E-1

	Men	Women
208-g	11111	
GS-17	1	
GS-16	11111	
GS-15	1111111111111111 =	
GS-14	1111111111111111 ===	
GS-13	1111111111111 ====	
GS-12	1111111111 =====	
GS-11	11111 ==========	
GS-10		
GS-09	1111111111 ==========	
GS-08		
GS-07	1111 ==========	
GS-06		
GS-05	11 =====	
GS-04		
GS-03		
GS-02		
GS-01		

Median Grade 14.07 9.68 Median difference= 4.39

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
208-g	78	78	0	0.0	5.8	0.0
GS-17	13	13	0	0.0	6.8	0.0
GS-16	83	81	2	2.4	12.8	0.2
GS-15	282	255	27	9.6	31.8	2.8
GS-14	314	265	49	15.6	51.5	7.6
GS-13	259	197	62	23.9	66.1	13.7
GS-12	230	145	85	37.0	76.9	22.0
GS-11	243	81	162	66.7	83.0	37.8
GS-10	4	1	3	75.0	83.0	38.0
GS-09	531	146	385	72.5	93.9	75.6
GS-08	2	0	2	100.0	93.9	75.8
GS-07	220	56	164	74.5	98.1	91.8
GS-06	4	1	3	75.0	98.1	92.1
GS-05	102	24	78	76.5	99.9	99.7
GS-04	2	0	2	100.0	99.9	99.9
GS-03	1	1	0	0.0	100.0	99.9
GS-02	1	0	1	100.0	100.0	100.0
GS-01	0	0	0	0.0	100.0	100.0
Total	2369	1344	1025	43.3		
Senior*	1029	889	140	13.6		

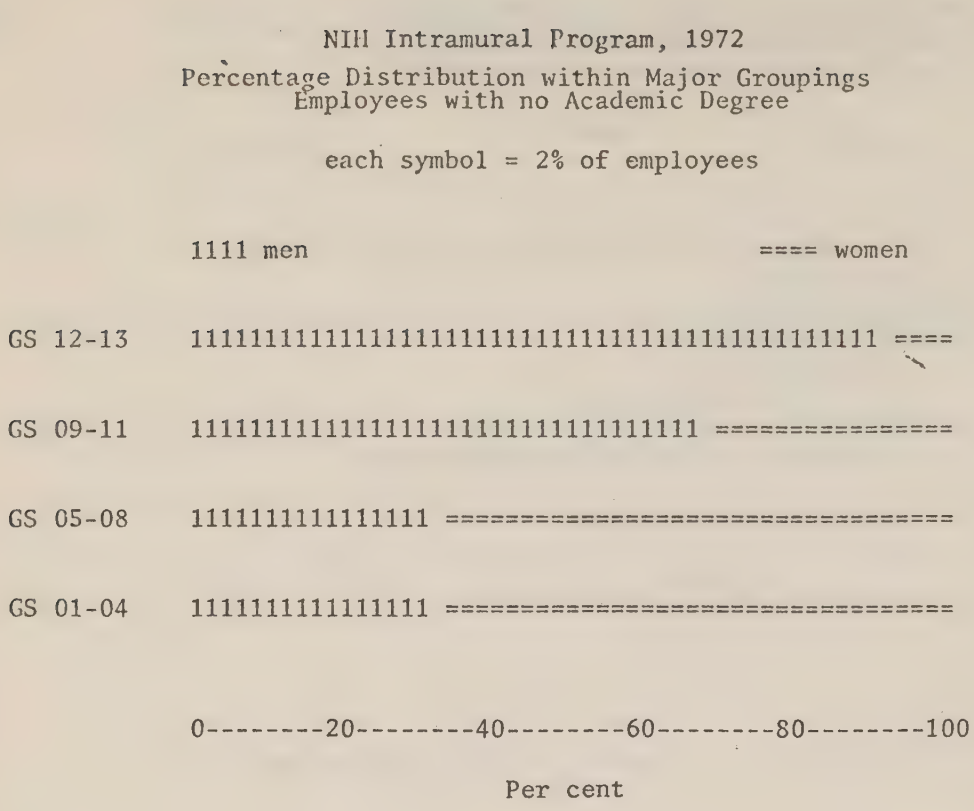
Percentage of employees having specified grade or higher
* Grades GS-13 or higher
Source:Systems and Actions Report, June 1972

Figure 4

E-1

NIH Intramural Program, 1972
Percentage Distribution within Major Groupings
Employees with no Academic Degree

each symbol = 2% of employees



Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
GS 16+	0	0	0	0.0	0.0	0.0
GS 14-15	11	10	1	9.1	1.7	0.1
GS 12-13	50	46	4	8.0	9.4	0.6
GS 09-11	274	189	85	31.0	41.0	10.8
GS 05-08	878	284	594	67.7	88.5	81.9
GS 01-04	220	69	151	68.6	100.0	100.0

Percentage of employees having specified grade or higher
Source:NIH ARMS system printout, Aug.1972

Grade 208-g's included in GS-16+

Bars for the upper two groupings are not shown because of the small numbers of employees in these positions.

*

Figure 5

NIH Intramural staff, 1972
Employees with no Academic Degree
(each symbol represents 10 employees)

E-1

	Men	Women
208-g		
GS-17		
GS-16		
GS-15		
GS-14	1	
GS-13	11	
GS-12	111	
GS-11	11111	=
GS-10	1	
GS-09	1111111111	=======
GS-08	1	==
GS-07	111111111	==========
GS-06	1111111	==========
GS-05	111111111	==========
GS-04	1111	==========
GS-03	11	===
GS-02	1	=
GS-01		

Median Grade 7.61 6.18 Median difference= 1.43

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
208-g	0	0	0	0.0	0.0	0.0
GS-17	0	0	0	0.0	0.0	0.0
GS-16	0	0	0	0.0	0.0	0.0
GS-15	0	0	0	0.0	0.0	0.0
GS-14	11	10	1	9.1	1.7	0.1
GS-13	18	18	0	0.0	4.7	0.1
GS-12	32	28	4	12.5	9.4	0.6
GS-11	66	54	12	18.2	18.4	2.0
GS-10	6	6	0	0.0	19.4	2.0
GS-09	202	129	73	36.1	41.0	10.8
GS-08	33	10	23	69.7	42.6	13.5
GS-07	268	115	153	57.1	61.9	31.9
GS-06	258	73	185	71.7	74.1	54.0
GS-05	319	86	233	73.0	88.5	81.9
GS-04	141	39	102	72.3	95.0	94.1
GS-03	53	20	33	62.3	98.3	98.1
GS-02	23	8	15	65.2	99.7	99.9
GS-01	3	2	1	33.3	100.0	100.0
Total	1433	598	835	58.3		
Senior*	29	28	1	3.4		

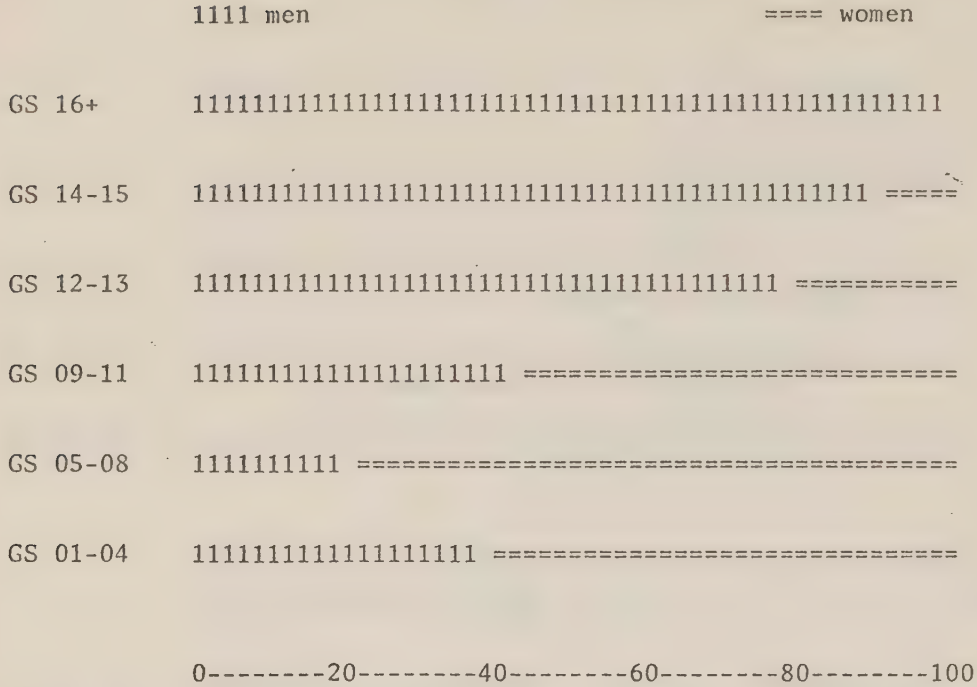
Percentage of employees having specified grade or higher
* Grades GS-13 or higher
Source:NIH ARMS printout, Aug 1972
*

Figure 6

E-1

NINDS GS Personnel,June 1972
Percentage Distribution within Major Groupings
each symbol = 2% of employees

1111 men ==== women



Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
GS 16+	19	19	0	0.0	9.6	0.0
GS 14-15	55	49	6	10.9	34.5	2.4
GS 12-13	57	44	13	22.8	56.9	7.6
GS 09-11	90	37	53	58.9	75.6	28.7
GS 05-08	203	39	164	80.8	95.4	94.0
GS 01-04	24	9	15	62.5	100.0	100.0

Percentage of employees having specified grade or higher
Source:EEO Quarterly Report,June 1972

*

Figure 7

NINDS GS Personnel
Grade Distribution by Sex, June 1972
(each symbol represents 2 employees)

E-1

	Men	Women
208-g	11111	
GS-17	1	
GS-16	11111	
GS-15	1111111111111 =	
GS-14	111111111111 ==	
GS-13	1111111111 ===	
GS-12	1111111111111 ===	
GS-11	1111111 =======	
GS-10	1 =	
GS-09	11111111111 ==================	
GS-08	1 =	
GS-07	11111111 ================================	
GS-06	111111 ==================	
GS-05	111111 ==============================	
GS-04	111 ======	
GS-03	11 =	
GS-02	1	
GS-01		

Median Grade 12.54 7.22 Median difference= 5.32

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
208-g	9	9	0	0.0	4.6	0.0
GS-17	1	1	0	0.0	5.1	0.0
GS-16	9	9	0	0.0	9.6	0.0
GS-15	27	25	2	7.4	22.3	0.8
GS-14	28	24	4	14.3	34.5	2.4
GS-13	25	19	6	24.0	44.2	4.8
GS-12	32	25	7	21.9	56.9	7.6
GS-11	28	14	14	50.0	64.0	13.1
GS-10	4	2	2	50.0	65.0	13.9
GS-09	58	21	37	63.8	75.6	28.7
GS-08	4	1	3	75.0	76.1	29.9
GS-07	80	15	65	81.3	83.8	55.8
GS-06	47	11	36	76.6	89.3	70.1
GS-05	72	12	60	83.3	95.4	94.0
GS-04	17	5	12	70.6	98.0	98.8
GS-03	6	3	3	50.0	99.5	100.0
GS-02	1	1	0	0.0	100.0	100.0
GS-01	0	0	0	0.0	100.0	100.0
Total	448	197	251	56.0		
Senior*	99	87	12	12.1		

Percentage of employees having specified grade or higher
* Grades GS-13 or higher
Source:EEO Quarterly Report
*

Figure 8

E-1

NINCDS SCIENTIFIC AND PROFESSIONAL STAFF
MARCH 30,1974
(each symbol represents 1 employees)

	Men	Women
208-g	11111111	
GS-17	1	
GS-16	111111111	
GS-15	11111111111111111111	==
GS-14	111111111111111111	=====
GS-13	111111111111	===
GS-12	1111111111	==
GS-11	11111	========
GS-10		
GS-09	111	=================
GS-08		
GS-07	1	=============
Median Grade	14.71	9.7 Median difference=5.01

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
208-g	8	8	0	0.0	8.8	0.0
GS-17	1	1	0	0.0	9.9	0.0
GS-16	9	9	0	0.0	19.8	0.0
GS-15	24	22	2	8.3	44.0	4.0
GS-14	24	19	5	20.8	64.8	14.0
GS-13	16	13	3	18.8	79.1	20.0
GS-12	12	10	2	16.7	90.1	24.0
GS-11	13	5	8	61.5	95.6	40.0
GS-10	0	0	0	0.0	95.6	40.0
GS-09	20	3	17	85.0	98.9	74.0
GS-08	0	0	0	0.0	98.9	74.0
GS-07	14	1	13	92.9	100.0	100.0
Total	141	91	50	35.5		
Senior*	82	72	10	12.2		

Percentage of employees having specified grade or higher
* Grades GS-13 or higher
Source:NIH EEO QUARTERLY REPORT,MARCH 1974

Figure 9

E-1

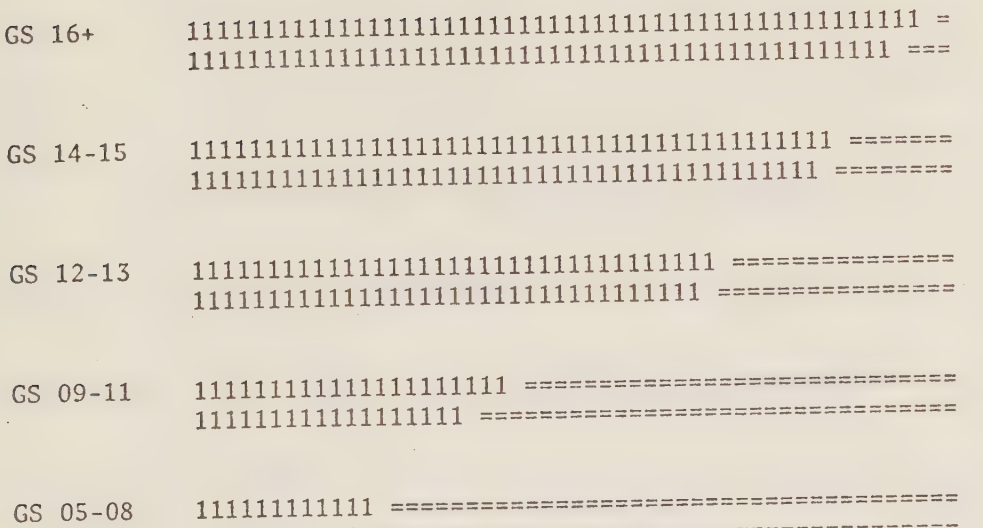
NIH GS STAFF, 1972,1976

Percentage Distribution within Major Groupings

Upper line 1972;Lower line 1976

each symbol = 2% of employees

1111 men ==== women



Source: EEO Quarterly Reports,June 1972, June 1976

Grade 208-g's included in GS-16+

Figure 10

E-1

NIH GS STAFF, JUNE 1976

Percentage Distribution within Major Groupings

each symbol = 2% of employees

1111 men ==== women

GS 16+ 1111111111111111111111111111111111111111111111 ===

GS 14-15 11111111111111111111111111111111111111111 ========

GS 12-13 1111111111111111111111111111111 ===============

GS 09-11 11111111111111111 ================================

GS 05-08 1111111111 ====================================

GS 01-04 111111111111111 ==================================

0--------20--------40--------60--------80--------100

Per cent

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
GS 16+	175	166	9	5.1	4.5	0.2
GS 14-15	867	726	141	16.3	24.0	2.6
GS 12-13	1157	789	368	31.8	45.3	8.9
GS 09-11	2031	717	1314	64.7	64.6	31.5
GS 05-08	3455	773	2682	77.6	85.4	77.5
GS 01-04	1851	540	1311	70.8	100.0	100.0

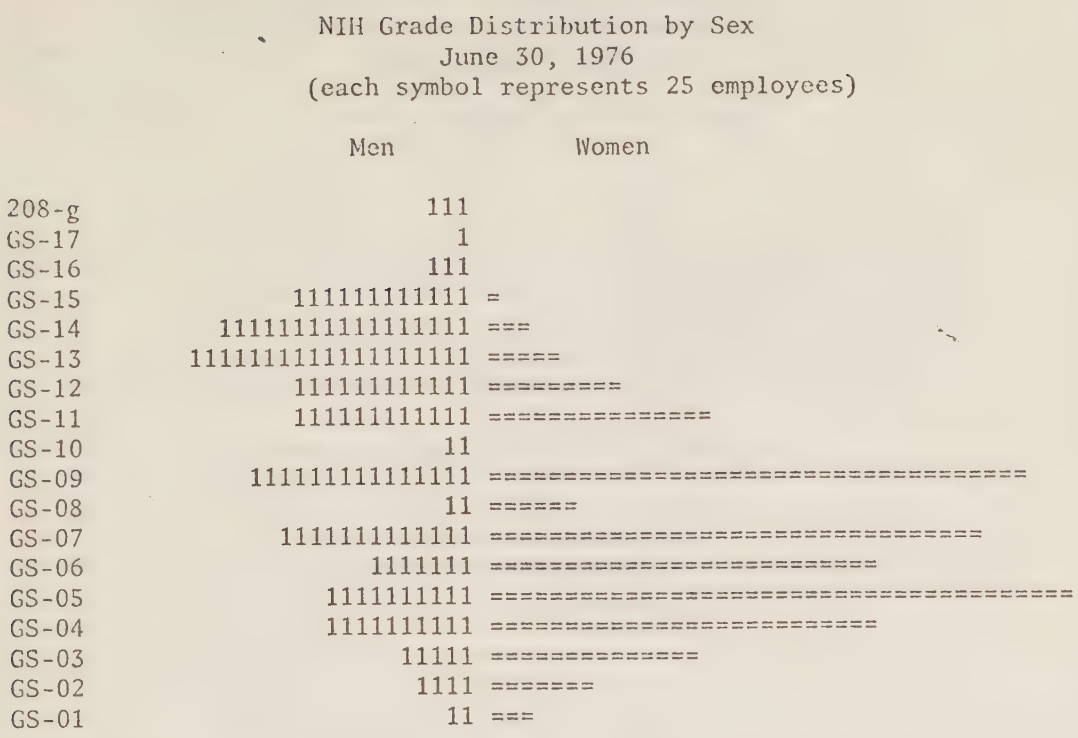
Percentage of employees having specified grade or higher
Source: EEO Quarterly Report, June 1976

Grade 208-g's included in GS-16+

Figure 11

E-1

NIH Grade Distribution by Sex
June 30, 1976
(each symbol represents 25 employees)



Median Grade 11.43 6.9 Median difference = 4.53

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
208	78	76	2	2.6	2.0	0.0
17	16	16	0	0.0	2.5	0.0
16	81	74	7	8.6	4.5	0.2
15	348	303	45	12.9	12.6	0.9
14	519	423	96	18.5	24.0	2.6
13	618	480	138	22.3	37.0	4.9
12	539	309	230	42.7	45.3	8.9
11	703	310	393	55.9	53.7	15.6
10	60	40	20	33.3	54.7	16.0
9	1268	367	901	71.1	64.6	31.5
8	216	45	171	79.2	65.8	34.4
7	1161	318	843	72.6	74.4	48.9
6	838	165	673	80.3	78.8	60.4
5	1240	245	995	80.2	85.4	77.5
4	921	256	665	72.2	92.3	88.9
3	499	129	370	74.1	95.8	95.3
2	298	104	194	65.1	98.6	98.6
1	133	51	82	61.7	100.0	100.0
Total	9536	3711	5825	61.1		
Senior*	1660	1372	288	17.3		

Percentage of employees having specified grade or higher
* Grades GS-13 or higher
Source: NIH EEO Quarterly Report, June 30, 1976

Figure 12

NINCDS GS PERSONNEL
JUNE 1976
(each symbol represents 2 employees)

E-1

	Men	Women
208-g	1111	
GS-17	1	
GS-16	1111	
GS-15	111111111111111	
GS-14	1111111111	====
GS-13	1111111111111	===
GS-12	1111111111	====
GS-11	111111	==========
GS-10	11	
GS-09	1111111111	==========
GS-08		=====
GS-07	11111111	==========
GS-06	1111	==========
GS-05	1111	==========
GS-04	11	===
GS-03	1	=
GS-02		
GS-01		

Median Grade 13 7.62 Median difference= 5.38

Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
208-g	8	8	0	0.0	4.4	0.0
GS-17	2	2	0	0.0	5.6	0.0
GS-16	7	7	0	0.0	9.4	0.0
GS-15	30	29	1	3.3	25.6	0.4
GS-14	27	19	8	29.6	36.1	3.7
GS-13	31	25	6	19.4	50.0	6.2
GS-12	28	19	9	32.1	60.6	9.9
GS-11	32	11	21	65.6	66.7	18.6
GS-10	4	4	0	0.0	68.9	18.6
GS-09	65	19	46	70.8	79.4	37.6
GS-08	11	0	11	100.0	79.4	42.1
GS-07	65	15	50	76.9	87.8	62.8
GS-06	52	8	44	84.6	92.2	81.0
GS-05	44	8	36	81.8	96.7	95.9
GS-04	11	4	7	63.6	98.9	98.8
GS-03	4	2	2	50.0	100.0	99.6
GS-02	1	0	1	100.0	100.0	100.0
GS-01	0	0	0	0.0	100.0	100.0
Total	422	180	242	57.3		
Senior*	105	90	15	14.3		

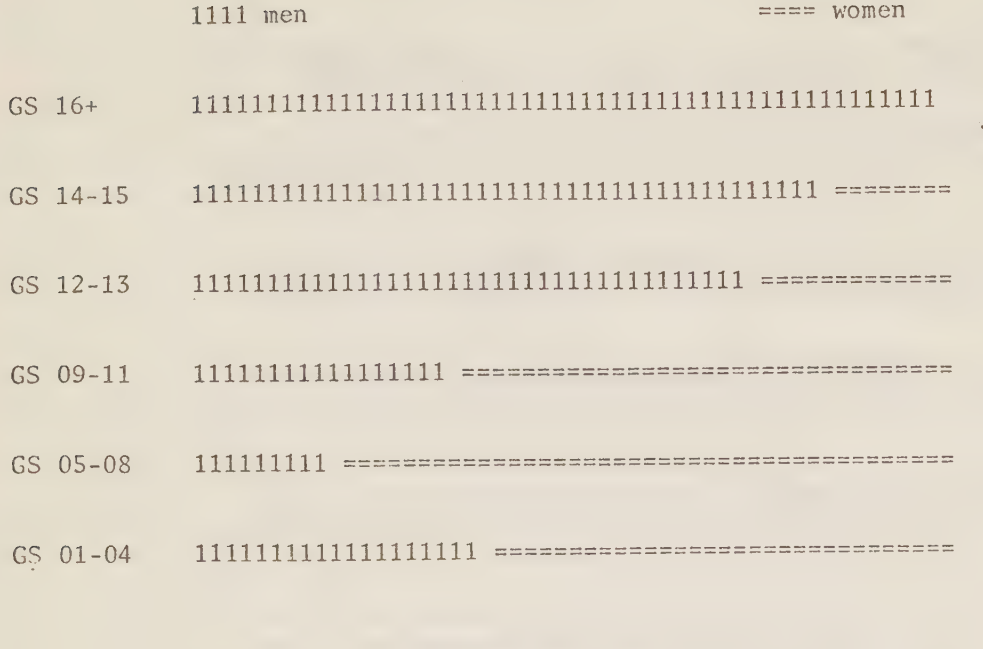
Percentage of employees having specified grade or higher
* Grades GS-13 or higher
Source:SYSTEMS AND ACTIONS REPORT, JUNE 1976
*

NINCDS PERCENTAGE DISTRIBUTION IN MAJOR GRADE GROUPINGS

E-1

JUNE 1976

each symbol = 2% of employees



Grade	Numbers			Women as	Cumulative % #	
	Total	Men	Women	% of total	Men	Women
GS 16+	17	17	0	0.0	9.4	0.0
GS 14-15	57	48	9	15.8	36.1	3.7
GS 12-13	59	44	15	25.4	60.6	9.9
GS 09-11	101	34	67	66.3	79.4	37.6
GS 05-08	172	31	141	82.0	96.7	95.9
GS 01-04	16	6	10	62.5	100.0	100.0
Total	422	180	242	57.3		

Percentage of employees having specified grade or higher
Source:SYSTEMS AND ACTIONS BRANCH REPORT, JUNE 1976

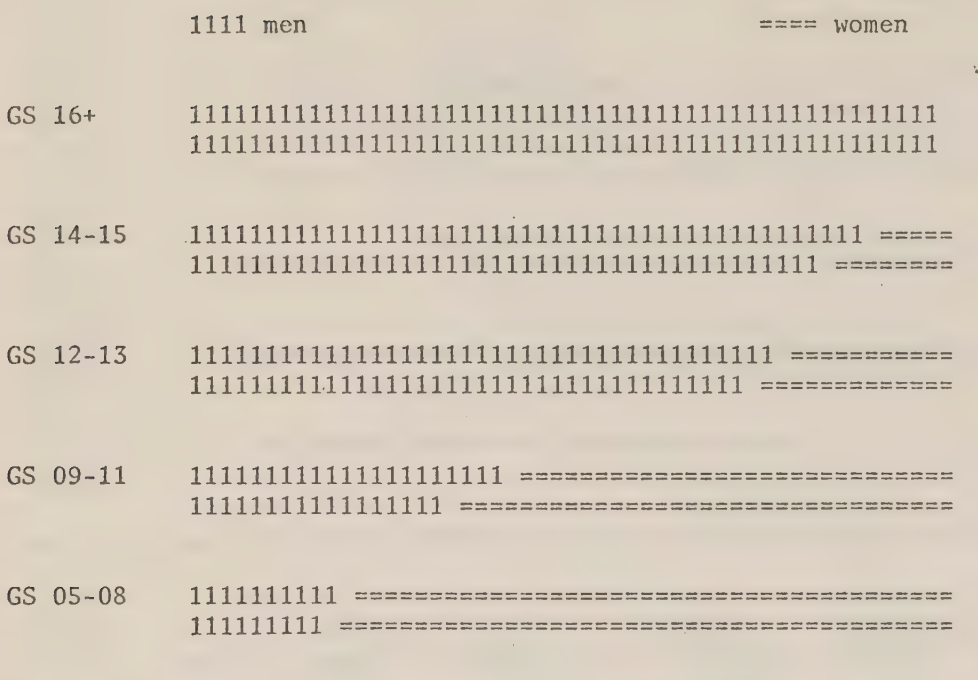
Grade 208-g's included in GS-16+

*

E-1

NINCDS Percentage Distribution by Sex within Major Groupings
June 1972, June 1976
Upper line 1972, lower line 1976

each symbol = 2% of employees



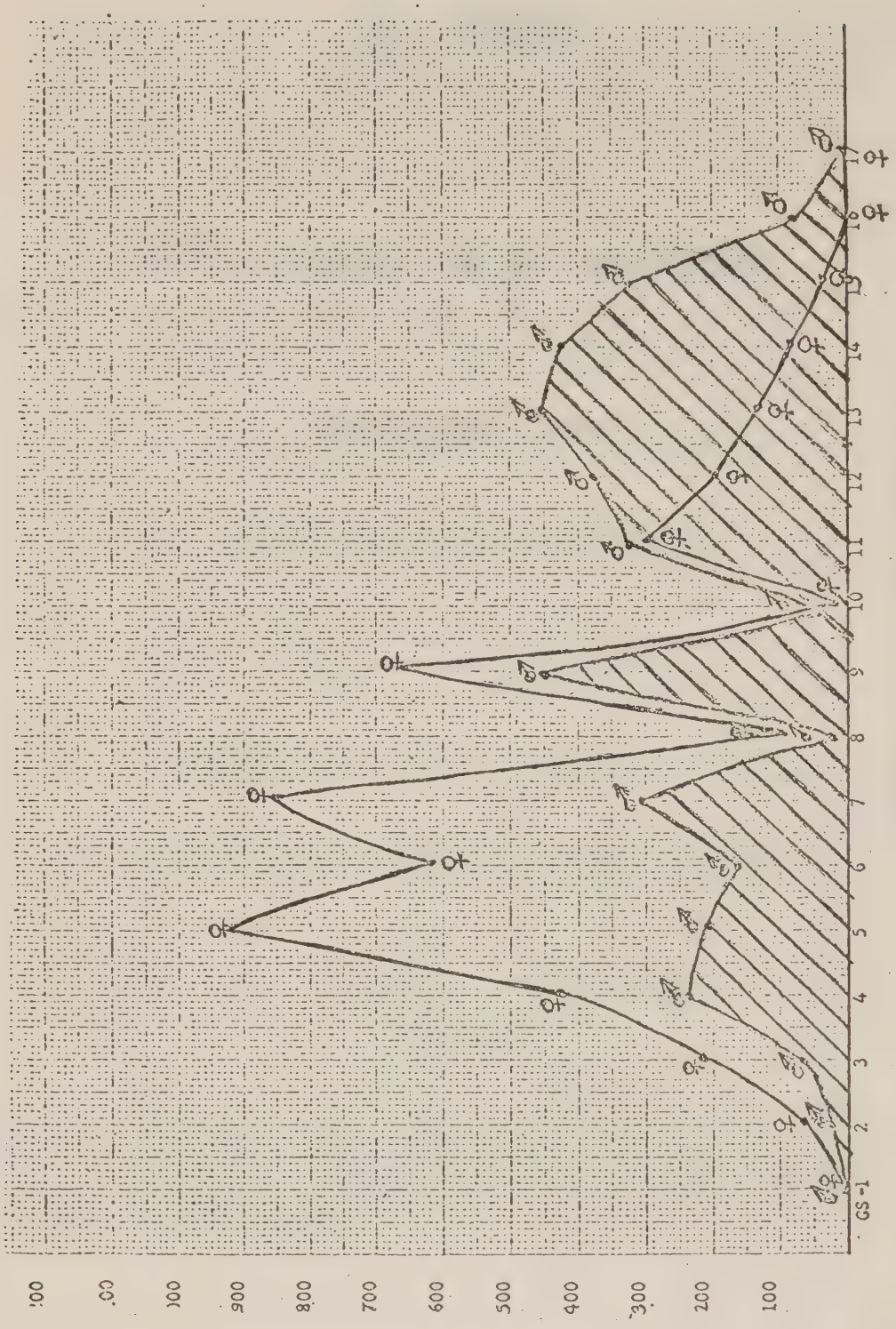
Percentage of employees having specified grade or higher
Source:Systems and Actions Branch Reports, June 1972, June 1976

Grade 208-g's included in GS-16+

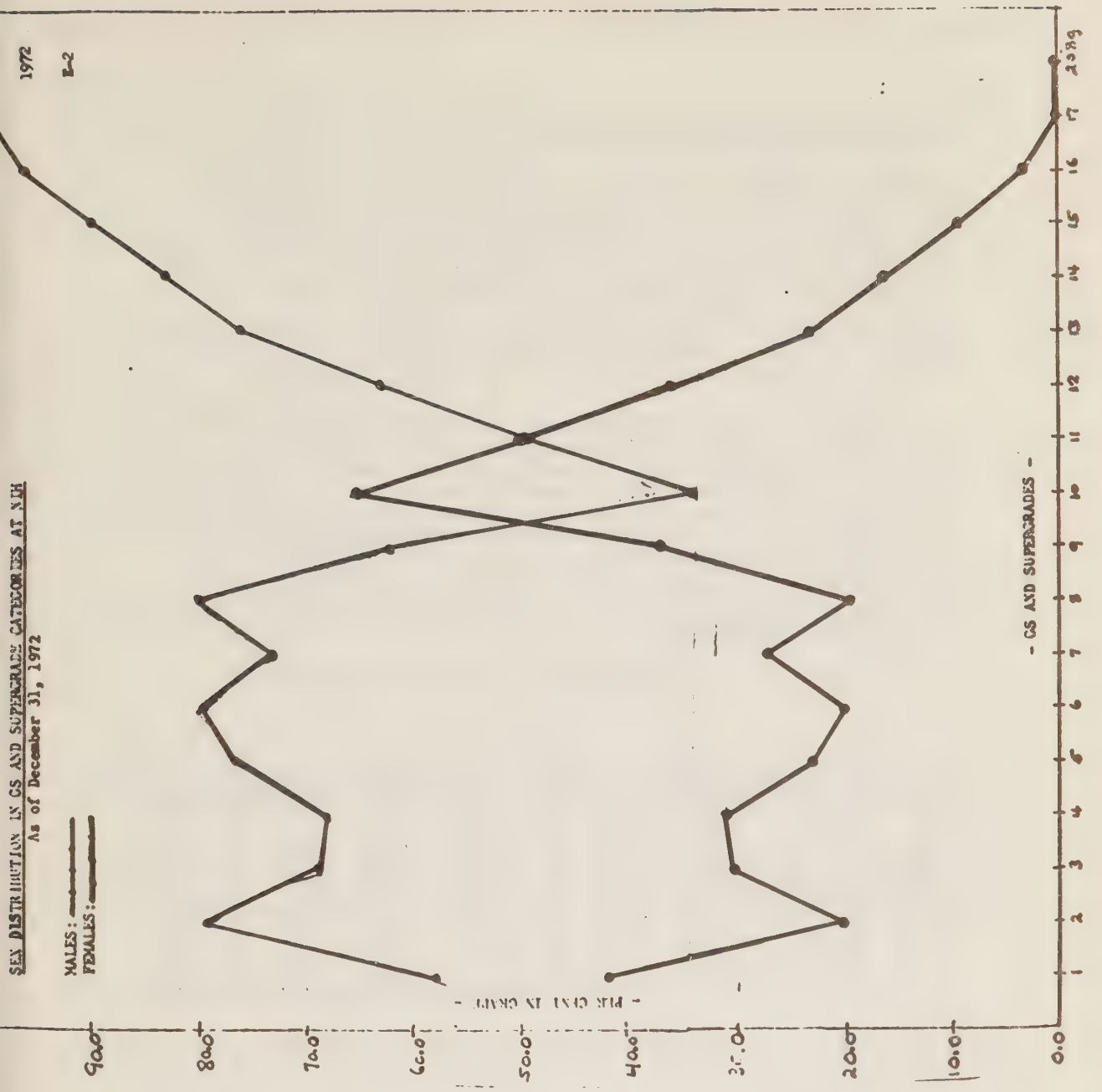
APPENDIX E-2

STATISTICS ON SEX DISCRIMINATION

NIH: 1971-1979



GRADE LEVELS OF FULL TIME GS STAFF AT NIH
February 1, 1971


1972
E-2
SEX DISTRIBUTION IN GS AND SUPERGRADE CATEGORIES AT NIH
As of December 31, 1972
MALES:
FEMALES:
- PER CENT IN GRADE -
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 2399
- GS AND SUPERGRADES -

Discrimination Statistics from HEW

In our January-February issue we showed that the difference in average grade between men and women at NIH as of October 1972 was 3.36. The Federal Women's Program of HEW has provided similar information about all HEW agencies, as of June 1971 and December 1972. The table is shown below. The gap in average grade is called disparity, and its changes termed the disparity closure. A plus sign means that the gap is getting smaller, that is, women's grades are more nearly like those of men. A minus sign means the opposite - that the relative position of women is worsening. We note with dismay, although not surprise, that NIH has retrogressed - our closure is negative.

This table includes only GS grade employees, not staff fellows, commissioned officers, or 208g supergrades. These high level positions are almost exclusively held by men, so that the actual disparity is worse than that indicated by the average grade difference. The closure for all HEW is only .0038. Former Secretary Richardson extablished the Women's Action program on February 17, 1971, and transmitted Affirmative Action plans for women to Agency Heads and Regional Offices on June 4, 1971. Eighteen months later the gap between average grades of men and women had closed by .0038 - one tenth of one per cent.

AT THIS RATE IT WILL TAKE US 1500 YEARS TO ACHIEVE EQUALITY!

	JUNE 30,1971			DECEMBER 31,1972			
AGENCY	MEN	WOMEN	DISPARITY	MEN	WOMEN	DISPARITY	CLOSURE
OS	11.2852	6.8849	4.4003	11.5185	7.1875	4.3310	.0693
OE	12.2714	7.4046	4.8668	12.4889	7.5039	4.9850	-.1182
HSMHA	9.1864	6.1944	2.9920	9.3697	6.1888	3.1809	-.1889
SSA	9.4032	5.5516	3.8516	9.5513	5.6660	3.8853	-.0337
SRS	12.0951	7.3988	4.6963	12.3392	7.5670	4.7722	-.0759
FDA	11.1113	6.6005	4.5108	10.1328	6.3205	3.8123	.6985
NIH	10.1968	7.0347	3.1621	10.2807	7.0157	3.2650	-.1029
HEW	9.8901	5.9640	3.9261	9.9751	6.0528	3.9223	.0038

NO ROOM AT THE TOP -IF YOU'RE A WOMAN

We don't always need a computer to gather statistics on sexism. The table below is derived from the NIH telephone directory(January 1973), pages 163 and 164. These are the top scientific policy making bodies of NIH

Top Level NIH Staff Committees- Jan . 1973

Staff Committees	No. of men	No. of women
Office of the Director, NIH	14	0
NIH Executive Manpower Council	10	1 *
Bureau, Instit., and Div. Directors	33	1 *
Scientific Directors	20	0
Medical Board	18	2 **
Collaborative Program Directors	17	0
Exec. Com. for Extramural Affairs	18	0
Total number of positions	145	4
Total number of people	99	3

* Ms. Jessie Scott, Director of Division of Nursing
** Two lay members of otherwise all medical and all male Committee

Of 149 positions, four are held by women, and two of those are "less equal". Even the last woman, Ms. Scott, is Director of Nursing, which is a female ghetto in the medical field.

Do your own research! Pages 100-166 of the NIH January 1973 telephone book give organizational listings for all of NIH. Look up your own B/I/D/O. How many Associate or Assistant Directors, Lab or Branch Chiefs, or Section Heads are women?

Sexism at the National Bureau of Standards

We reprint here a table of average grades at NBS, given in the MS. column of the NBS Standard, April, 1973. There has been no improvement in the past six years.

	CATEGORY							
Year	Professional		Technical		Administrative		Clerical	
	M	W	M	W	M	W	M	W
1967	12.7 (1106)*	11.0 (91)	8.3 (333)	6.2 (28)	11.2 (175)	9.7 (97)	4.8 (174)	4.8 (557)
1968	12.9 (1064)	11.4 (81)	8.7 (326)	6.7 (21)	11.1 (183)	9.5 (108)	4.9 (143)	4.8 (554)
1969	13.0 (1097)	11.2 (95)	8.6 (346)	6.4 (25)	11.3 (181)	9.5 (105)	5.0 (135)	4.9 (535)
1970	13.1 (1115)	11.3 (91)	8.9 (347)	6.2 (26)	11.3 (160)	9.5 (80)	5.1 (84)	5.0 (419)
1971	13.1 (1160)	11.1 (93)	9.0 (334)	5.6 (31)	11.2 (155)	9.6 (85)	5.2 (91)	5.1 (424)
1972	13.1 (1180)	11.5 (89)	8.9 (324)	6.6 (20)	11.4 (161)	9.8 (83)	5.2 (93)	4.9 (458)

*Numbers in parentheses show total persons in category.

SHER Newsletter September-October 1973 1973

LEGAL ACTION AND AFFIRMATIVE INACTION E-2

NIH has had Affirmative Action Plans since at least May, 1969. How much progress have women made? We print here statistics for the past two years, derived from the NIH minority employment reports.

Grade Structure at NIH			
	Sept.'71	Oct.'72	July'73
Average grade for men	10.49	10.12	10.30
Average grade for women	7.08	6.76	6.96
Difference in average grade	3.41	3.36	3.34
Women as % of total workforce	56.1	58.7	56.4
Women as % of senior staff (GS-13 and above)	15.4	16.4	15.8

There has been no significant change in the disparity in average grade between men and women, nor in the percentage of women in the higher grades. Management blames personnel ceilings and grade de-escalation for the lack of progress. This is a phony argument. There have been a substantial number of promotions and hirings but they have followed the old discriminatory patterns. Women's grade disadvantage is as great as ever.

To see the effect of legal action, let's look at some statistics on NIH public advisory committees. In March of 1972, American Women in Science (AWIS), National Organization for Women (NOW), and some other women's groups filed a class action suit against NIH charging sex discrimination in selection of committee members. The table below shows a very different before and after picture.

Composition of NIH Public Advisory Committees		
	Jan.'72	June'73
Total Number of Members	1954	2120
Number of Women	176	386
Women as % of membership	9	18

The percentage of women has doubled. And the suit has not even been tried in court - merely filing the action and winning the preliminary legal skirmishes has had results. The point is obvious. Affirmative action is based on good faith on the part of management. Legal action compels obedience to the laws. Many in the EEO community are beginning to realize that we may need the muscle of the courts as well as the persuasion and education of the EEO program if we are to make any real changes in the white male domination of NIH.

SHER Newsletter January - February 1974 1974

E-2

A NEW STATISTIC - FLUNKYISM

We have shown before the gross disparity between median grades for men and women at NIH. We have now looked at statistics for a number of occupational series and find that for all occupations, those requiring high professional scientific training and those requiring practically no training, women are discriminated against in three ways.

1. Exclusivism - women are kept out of the most prestigious and lucrative series
2. Inequality - women are relegated to the lower grades of the series
3. Flunkyism - women are not given supervisory jobs in proportion to their numbers within the series

Exclusion from supervisory positions is a serious form of discrimination, since these jobs carry power and prestige, control over hiring, training, and promotions, and are a stepping stone to the highest levels. We introduce in this article a new statistic, which we call the Flunky Factor, (FF). It is best explained by an example. Suppose that there are 100 employees in a series - 60 men and 40 women. And suppose that there are 20 supervisors - 15 men and 5 women. Then one out of every 4 men (15 out of 60) is a supervisor, but only one out of 8 women (5 out of 40) has such a job. The FF is 2 (8 divided by 4), i.e. a man has twice the chance of a woman to hold a supervisory job.

Below are tabulated statistics on a number of important series, as of October 1973

Occupation		Exclusiveness		Inequality			Flunkyism		
Code	Title	# of Employees		Median Grades			# of Supervisors		
		Total	% Women	Women	Men	Disparity	Total	%Women	FF
602	Medical Officer	261	13.4	14.7	15.5	0.8	131	2.3	6.6
1320	Chemist	490	41.8	10.0	13.5	3.5	90	10.0	6.4
401	Biologist	305	55.0	10.0	10.2	0.2	28	21.0	4.6
1102	Contract Assistant	138	30.4	10.8	12.7	1.9	29	10.3	3.8
404	Biological Aid	666	39.3	5.0	6.0	1.0	28	14.0	3.8
345	Program Analyst	103	39.8	12.3	13.9	1.6	19	16.0	3.5
305	Mail Clerk	100	53.0	3.9	4.5	0.6	19	26.0	3.2
403	Microbiologist	151	45.0	10.0	13.3	3.3	28	20.7	2.9
601	Health Scientist	248	18.0	14.4	15.0	0.6	74	8.1	2.6
1530	Statistician	90	44.5	12.6	14.4	1.7	21	33.0	2.4
301	General clerical	1032	84.5	6.2	7.4	1.2	81	74.0	1.9
201	Personnel Admin.	85	50.6	12.2	12.2	0.0	20	35.0	1.9
334	Computer Programmer	260	30.4	11.0	12.5	1.5	43	21.0	1.7

The two highest paying series- 602 and 601 have the lowest percentage of women. The two most prestigious- 602 and 1320- are the worst in flunkyism. Even among mail clerks, where higher education is not a factor, a man has better than three times the chance of a woman to be a supervisor.

These numbers answer an often heard argument. It is not true that the vast disparity in grade between men and women is attributable to a lack of professionally trained women scientists. Professionally trained women are underutilized, and discrimination exists in administrative and clerical as well as scientific areas.

SHER Newsletter March-April 1974

1974

E-2

The Commissioned Corps of the Public Health Service- Sexism and Injustice

Statistics

As of September 30, 1973, there were 1031 commissioned officers at NIH. Of these, 68, less than 7%, were women. Nurses accounted for 44 of the 68 women. The most prestigious positions are of course the medical posts- physicians also earn premium pay ranging from additional $1200 to $4200 per annum, depending on years of service. Of 711 physicians, only 5, or less than 1%, are women. And of these 5, 3 are wives of members of the white male elite at NIH. We have noted for some time that a disproportional share of high grades, distinctions, and other rewards seem to go to wives of the NIH ruling hierarchy, but these Corps nepotism statistics are the most striking.

EEO in the Corps

Although members of the Corps at NIH work side by side with Civil Service employees, they do not have the protection of Civil Service status, or the rights of the EEO complaint procedures applicable to Civil Servants. For example, they can be involuntarily retired because of an unsatisfactory performance rating. There is no right of appeal from such retirement. EEO complaints are investigated according to CSC regulations, but the decision is made by the Public Health Service, and there is no right to a hearing, or an appeal to the Civil Service Commission Board of Appeals and Review. The involuntary retirement is not often applied- since 1956, only 24 officers have been retired, but of these, 9 were women- all nurses.

A CASE HISTORY

Ms. N. was a nurse officer in the Commissioned Corps. The attitude of her Lab Chief, also in the Corps, was shown by such remarks as:

> "This meeting is about EEO. There'll be no more promotions around here. Is there anything else you want to talk about?"
>
> "Supervisory training is for places like IBM and GM. It doesn't apply to us."

Subsequent to her attempt, as an EEO counsellor, to help a nursing assistant gain a promotion, Ms. N. was given a bad efficiency rating and asked to retire in July 1971. In August 1971 she filed a formal EEO complaint, and in October 1971 she was involuntarily retired, before her complaint was investigated. Her investigation started in April 1972 and was not completed until August. The case was investigated further in February 1973, and a final report sent to PHS in March. Not until October 1973 was action taken - the Retirement Board reconvened, and simply affirmed its previous decision, denying any discrimination. The retirement board did not permit Ms. N. or her attorney to attend its meeting, to present her side of the case, or to present witnesses who could challenge the statements derogatory to her.

In the Civil Service, an EEO complainant is protected against reprisals. In the Corps, a complainant can be retired as soon as she files a complaint. The effect of this policy on EEO in the Corps need not be further explained - the case speaks for itself.

SHER Newsletter- November-December 1974 1974

BREAKING THE GS -9 to -11 BARRIER E-2

The barrier between GS grades 9 and 11 has been insurmountable for NIH research support personnel. NIH administrators and senior scientists have viewed promotion of non-doctoral professionals to GS-11 as a compromise to their professional prestige, as this is the lowest level at which doctoral personnel are hired. Also, promotion decisions have been made by an inter-institute Scientific Directors Board of Review, rather than researchers familiar with the candidates' work.

Years ago, when some doctors were being hired at Grade 9, there existed, predictably enough, a GS-7 to -9 barrier. Because other agencies had no such blockages, those who were professionally ambitious transferred elsewhere, resulting in continuous depletion of good support researchers.

Long-existent social and educational inequities have resulted in a disproportionately low number of women and minority PhD's and MD's. Such degrees are not bona fide qualification to do independent research - even Civil Service has no such requirement - and NIH insistence on them was attached as de facto discrimination in the class action lawsuit filed in November 1973 of which SHER is coplaintiff.

Some elements of the Equal Employment Opportunities (EEO) organization here at NIH felt it imperative to become involved in barrier busting. In 1970, one institute's EEO advisory committee had identified the problem, began discussing it and applying pressure on NIH's EEO Council, the institute Scientific Directors and at several off-campus conferences. Senior scientists and some institute Scientific Directors, displeased about depletion of quality personnel as well as career limitations for individuals, became involved in the struggle as did support researchers themselves.

The Scientific Director of one institute established a review panel for promotions. This consisted of one specialist from outside the institute actively engaged in each research area in which promotions were being considered, who examined the candidate's record and knowledge. Of nine proposed candidates, all but one (and all of the women and minorities) were found qualified for promotion to GS-11.

Both EEO and the Scientific Directors yielded to pressure in a characteristic manner - they formed ad hoc committees to study the barrier. The "Benchmark" Committee established by the Scientific Directors was generally unproductive, but an important outcome was a report written by Dr. Edward Korn, NHLI representative to the committee, to NIH's Deputy Director for Science. He related that the committee wished to dispense with very specific position classification guidelines ("benchmarks") for GS-9 and -11. The success of the promotion system from GS-12 to -15 is because of its flexibility, which should, the committee said, be extended to support positions as well. Position classification has been the governing rule at lower GS grades and has been invoked to prevent movement of support personnel into the investigator class. Further, judgment by the Scientific Directors on promotions seemed destined to prolong this immobility.

Dr. Korn's experience on his institute's new Promotion Review Panel found that promotions from 9 to 11 no longer presented a special case. These promotions became more prevalent, not because promotion standards were lower, but because this group could better judge the ability of the individual to work independently and whether the researcher had achieved minimum standards for entry into the investigator class.

In the memo, Korn recommended that each Institute Director establish such a Promotion Review Panel to approve all promotions at least through GS-11 and send recommendations to the director. The panels would consist of from five to seven scientists of a variety of fields and levels, some of whom would sit on an Inter-Institute Promotion Standards Panel.

The NIMH/NIH EEO Advisory Counsils agreed strongly with these proposals and urged the Deputy Science Director for NIH to accept them, which he did in October of this year. Henceforth, all promotions up to GS-12 will be reviewed by institute panels rather than the Scientific Directors Board of Review.

(continued on page 2 -opposite)

1974
E-2

People who have been active in this barrier breakdown process as support personnel seeking GS-11 status and as ad hoc committee members emphasize the joint effort that accomplished this task. Had not EEO people, senior scientists, sympathetic Institute Scientific Directors and support scientists themselves become involved, the continuous pressure necessary to open communications with the NIH administration and render them receptive to such proposals might never have been applied. Because of their work, an atmosphere of relative openness and receptivity exists now within NIH administration and, with continued effort, these people and others concerned with inequitable employment situations should be able to accomplish much.

story by Hope Taylor

SHER Newsletter May-June 1977

Progress of Women At NIH: The Pace of a Comatose Snail

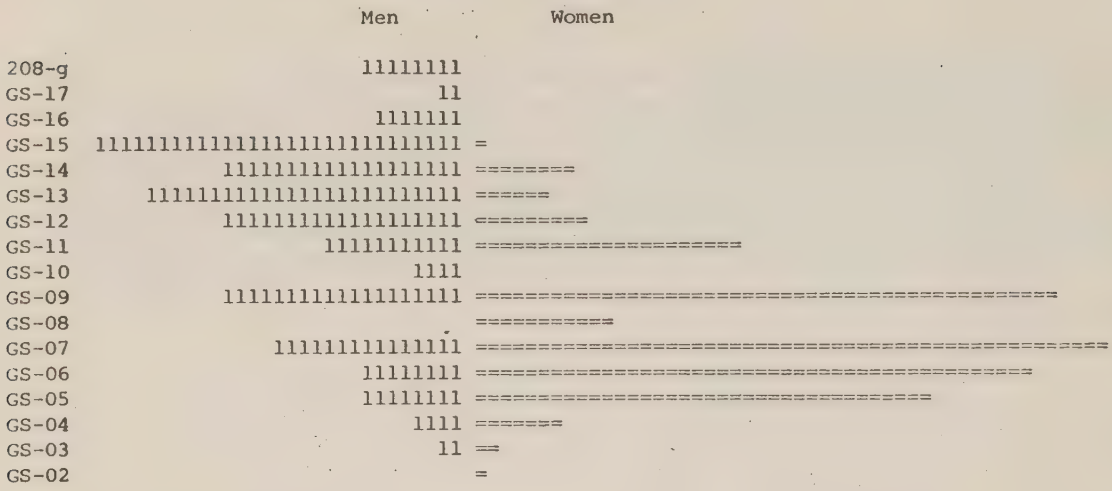
We're always hoping for progress in the position of women at NIH, so we keep looking at statistics. (Apparently nobody but us looks at the numbers). Here is the progress.

In 1972 the difference in median grade between men and women was 4.8. In 1976, it was 4.53. At this rate, 0.07 grades per year, a mere 65 years will bring us equality. Similarly, our proportion of the senior (GS-13 and above) staff has risen from 16.3% to 17.3% between 1972 and 1976. At this rate, it will take us 150 years to gain half of the senior jobs. However, be thankful for tokenism - our percentage of the supergrade jobs, GS-16 and above has risen at the astounding rate of almost 1% per year, and we now hold almost 6% of the top jobs. Room at the top should be equally available to us in only about 50 years.

Of course these times are a joke, both statistically and practically. But the problem is distressingly real; the gross disparity between grades of men and women persists.

NINCDS - Model for What? E-2

NINCDS GS PERSONNEL
JUNE, 1976
(each symbol represents 1 employee)



The National Institute for Neurological and Communicative Disorders and Stroke (NINCDS is reputedly a model institute for EEO. On its staff are two experienced EEO functionaries Levon Parker, EEO Coordinator, and Jean Oliver, formerly EEO Counsellor, now delegate to the Women's Advisory Committee. NINCDS has held EEO retreats, adopted Affirmative Action Plans, and generally made a production of its EEO effort. But has any output resulted from all this input?

The chart above speaks for itself, but let's look at some numbers. Is the status of NINCDS women any higher than it was? Does NINCDS treat its women any more fairly than NIH as a whole? The answer is no, to all these questions.

	NINCDS		NIH	
	1972	1976	1972	1976
Median GS grade for men	12.54	13	11.41	11.43
Median GS grade for women	7.22	7.62	6.61	6.9
Difference in median grade	5.32	5.38	4.8	4.53
% of senior staff female	12.1	14.3	16.3	17.3
% of supergrades female	0	0	1.6	5.1
% men who are GS 13 or over	44.2	50	36.3	37
% women who are GS 13 or over	4.8	6.2	5	4.9
Advantage of men for GS 13 or over	9.2	8	7.3	7.5

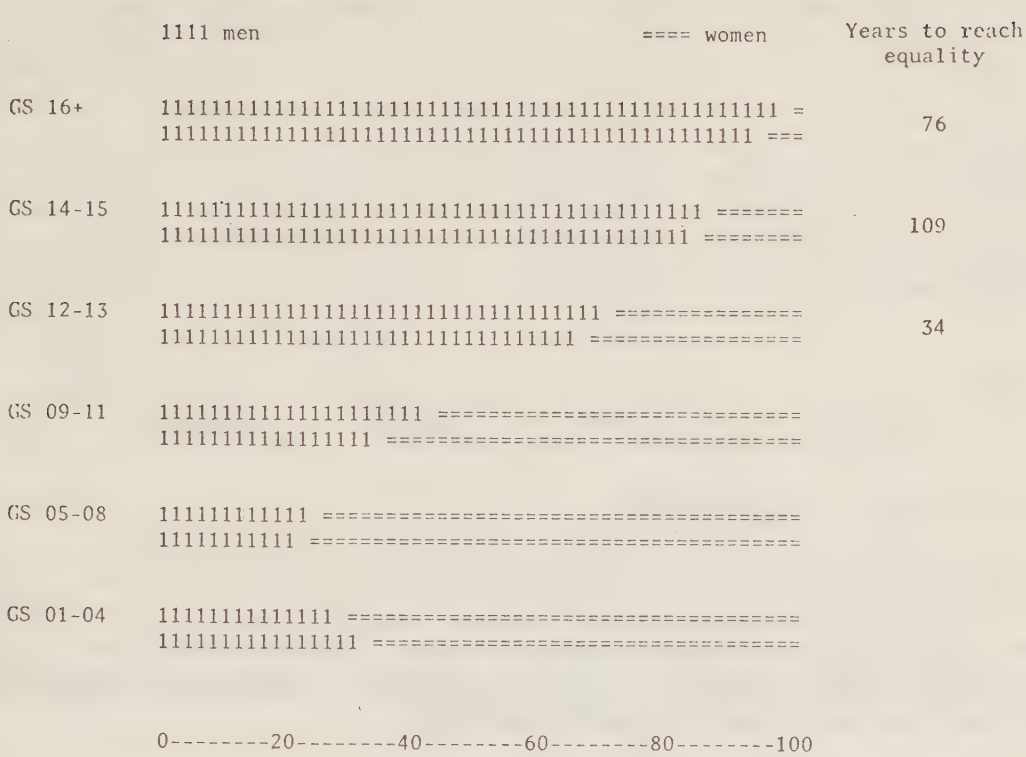
The gap in median NINCDS grade has increased since 1972, and is distinctly higher than that of NIH as a whole. A man's chance to be part of the senior staff is eight times that of a woman. Supergrades are all male.

What has all this EEO activity done for the women of NINCDS, or for that matter, NIH?

"MOURNFUL NUMBERS"

NIH Percentage by Grade Group and Sex, 1972 and 1977
Upper line, June 1972, lower line, June 1977

each symbol = 2% of employees



We in SHER like to look at the results of the so-called affirmative action programs at NIH. Management and the EEO bureaucracy look only at their efforts, which have always seemed to be more in the field of public relations than affirmative action. In any case, we present the dismal picture of the status of women over the last five years. Our projected time to equality, at the right, is a measure of the failure of the efforts.

Without goals and timetables, progress is negligible. The FAIR proposals, presented in 1975, would have achieved equality in about 10 years. Management often blames lack of turnover for lack of progress - this is not true. Turnover averages 15% per year, so in these 5 years, 75% of the positions turned over, but the good jobs went to the men, as usual.

Davis v. Califano Appealed

In the case Davis v. Califano, Judge Hart has ruled in favor of the defense. This ruling came despite overwhelming statistical evidence that women at NIH are not promoted as readily as men and that some men with B.S. degrees earn more than women with Ph.D.'s. An amicus curiae brief on behalf of the plaintiff had been filed by the American Civil Liberties Union of Montgomery County and Women's Equity Action League. The case has been appealed.

SWER Newsletter September-October 1978 1978

No Room at the Top - Women in the Intramural Research Program

E-2

The organizational listing in the September 1978 issue of the NIH telephone book shows the following distribution of women and men in the Division of Intramural Research, ranks as indicated (W=women; M=men)

	Scientific Director		Laboratory Chief		Branch Chief		Section Chief	
	W	M	W	M	W	M	W	M
NHLBI	0	1	1	9	0	7	4	31
NIAID	0	1	0	10	-	-	2	33
NIAMDD	0	1	0	10	0	8	2	44
NICHHD	0	1	0	3	0	4	0	22
NIA	0	1	0	2	0	1	0	8
NIDR	1	0	0	6	0	4	2	17
NIEHS	0	1	0	8	0	4	1	4
NINCDS	0	1	1	9	0	7	3	31
NEI	0	1	0	1	0	1	0	8
NIMH	0	1	0	10	0	3	1	15
Total	1	9	2	68	0	39	15	213
%W	10%		2.8%		0%		6.6%	

Have You Come a Long Way, Baby?

We hear a great deal about the progress of women at NIH. We like to look at the numbers and estimate the rate of progress.

Since women hold about 44% of all scientific and professional jobs here, we might expect them to hold the same percentage of the senior (GS-13 and higher) jobs. In 1971 women held 15.3% of these jobs, in 1978 they held 18.5%, a gain of 3.2% in seven years. At this rate, we'll need 55 years to reach equality.

SHER Newsletter November-December 1978 1978

E-2

NO ROOM AT THE TOP - WOMEN IN THE INTRAMURAL RESEARCH PROGRAM - PART II

Several readers of the September-October Newsletter have asked us why the National Cancer Institute was not included in the summary of statistics on the intramural research program at NIH. We did not use the information pertaining to the NCI from the September 1978 telephone directory since the NCI heading contained the statement that the listing "depicts the unofficial organizational structure."

As a result, we have compiled statistics from the official NIH Scientific Directory, 1978, for the intramural research program of the NCI and of the other institutes. With the exception of one female laboratory chief whom we failed to include in the earlier tabulation, the official directory shows the same distribution as the data reported in our last newsletter. NCI and total distribution are as indicated. The NIH total includes NHLBI, NIMH, and NCI. (W = women; M = men)

	Scientific Director		Laboratory Chief		Branch Chief		Section Chief	
	W	M	W	M	W	M	W	M
NCI	0	1	0	18	1	28	13	92
Total NIH	1	10	3	86	1	67	28	305
Percent Women	9.1%		3.4%		1.5%		8.4%	

Income Inequality in the Federal Government

Although the Federal Government should serve as a model equal opportunity employer, all women and minority men civil servants earn far less than their white male counterparts. A recent study, "Income Inequality in the Federal Government", by P. Taylor (American Sociological Review, Vol. 44: 468-479, June 1979) analyzed a 1% sample of federal employees, as of 1977. The method used, regression analysis, is the most sophisticated and accurate means of measuring inequality, since it compares salaries on the basis of age, length of federal service, educational attainment, and type and location of position. The numbers in the table show the difference in salary between the three groups considered and white men of comparable background.

LOSS OF SALARY DUE TO RACE AND SEX, Federal Civil Service, 1977

Occupational Group	Number of Employees in sample	Loss of Salary in Dollars		
		Non-minority Females	Minority Males	Minority Females
Professional	2,690	- 5,156	- 831	- 5,172
Administrative	3,321	- 3,909	- 1,519	- 4,862
Technical	2,924	- 1,587	- 1,673	- 2,320
Clerical	6,705	- 396	- 623	- 695
Other	272	- 480	- 524	- 1,107
TOTAL	15,912	- 3,476	- 1,994	- 3,970

Comparing the salary loss of non-minority women and minority men gives a rough estimate of the relative effects of sex and race discrimination. The totals show that sex discrimination is far worse overall - a loss of $3500 vs. $2000 in round numbers, per year. Among professionals, the impact of race on salary is almost non-existent (the $831 entry for minority men is not statistically significant) whereas both minority and non-minority women lose more than $5000 per year. Among technical and clerical workers, race is a slightly greater handicap than sex.

Studies such as this should be conducted by NIH, for the whole agency and for the separate BID's, to ascertain the nature and degree of sex and race discrimination throughout the institution.

Senator METZENBAUM. Thank you very much, Miss Dunkle. Our fourth and last witness is Mary Kostalos, codirector of women in science career facilitation program, Chatham College.

Senator SCHWEIKER. I wonder if I might interrupt, Mr. Chairman. I am very pleased to welcome Dr. Kostalos here today to the Health and Scientific Research Subcommittee. Dr. Kostalos is one of the directors of an excellent science education program for women at Chatham College in Pittsburgh, Pa.

I am very pleased to welcome you here, particularly since my wife is an alumna of Chatham College.

Senator METZENBAUM. Dr. Kostalos, we're happy to have you with us.

Dr. KOSTALOS. Thank you.

Senator METZENBAUM. And I'm also happy to have Senator Schweiker, the ranking minority member of our committee, join us.

Dr. KOSTALOS. Thank you very much, both of you.

I am here to talk briefly about a program which is already in existence at Chatham College. In 1977, Chatham College received a National Science Foundation grant for a career facilitation project, entitled "Industrial Chemistry With a Management Option." The project was refunded in 1979 and the new program is currently underway.

The program is designed to update the participants' backgrounds and skills in chemistry and to provide a basic foundation in management, computer science, and technical writing. This was accomplished through course and laboratory work, special workshops, and internships. The internship is a 1- or 2-month full-time work experience in industry.

The participants of our program are intelligent, highly motivated women. Many have had technical experience. Most left employment to raise families and had not worked for 5 years or more prior to entering the program. Most have degrees in chemistry, usually a B.A. or B.S. They range in age from the midtwenties to midfifties. Most received their degrees between 5 and 20 years ago.

In the 1978 program, 3 of 23 participants represented ethnic minority groups. In 1980, 5 of 28 women represented ethnic minorities.

The purpose of the NSF-funded career facilitation project is to encourage women to enter or reenter scientific careers. It is, of course, too early to predict what will happen to the 1980 participants who have just begun their course work. However, of the 23 participants in the 1978 program, 91 percent have been employed since the program was completed, or have entered graduate degree programs. Most are employed as chemists in industry. Others are working in a variety of other areas.

The median salary for those working full time is over $17,000. Three women from the program entered graduate study. One has completed her master's program and is now employed.

Programs such as the Chatham program provide a unique opportunity for women with technical backgrounds who wish to return to work after interrupting their careers. Reaching out to this group of women is in keeping with the philosophy of Chatham College.

Chatham College, a small liberal arts college for women, is vitally concerned with the education and advancement of all women.

Vital to the success of the program has been the cooperation of Government agencies and local industry. This cooperation has benefited the participants, college, and the community. Local companies have obtained valuable employees by recruiting women from the program. Other employees of these companies have been able to stretch themselves professionally by teaching in a college-level program.

The college has benefited in many ways. For example, the industrial contacts made through the program will provide internship possibilities for our regular students. Some companies which recruited women from women in science participants are now coming to the campus to recruit our undergraduates. The chemistry department has also benefited in a number of ways.

I would like to stress once again that Chatham College would not have been able to afford this program without NSF funding. A very important aspect of the 1980 grant was the provision of money for financial aid for some of the participants. Future support for participants to cover tuition and other expenses is critical if the program is to continue, and particularly if it is to reach those who need it most. There is strong evidence for the continuing need of this type of program. Our 1980 program had more inquiries and more applicants than the 1978 program. Employment in chemistry is expected to remain strong, at least through the mideighties. Women are severely underrepresented in chemistry. The need is there. The Chatham College women in science program and other similar programs can play a vital role in enabling talented and motivated women to enter or reenter careers in science.

Thank you.

[The prepared statement of Dr. Kostalos follows:]

A CAREER FACILITATION PROJECT FOR WOMEN IN INDUSTRIAL CHEMISTRY WITH A MANAGEMENT OPTION

A written statement prepared by Dr. Diane Wakefield and Dr. Mary Kostalos, Co-Directors of the Chatham College Women in Science program, as part of testimony before the Senate Committee on Labor and Human Resources hearing on the Women in Science and Technology Equal Opportunity Act, March 3, 1980

A CAREER FACILITATION PROJECT FOR WOMEN IN INDUSTRIAL CHEMISTRY WITH A MANAGEMENT OPTION

INTRODUCTION

In 1977, Chatham College received a Women in Science grant from the National Science Foundation to develop and establish a tuition-free Career Facilitation Project for twenty women, as part of a national effort to encourage women to enter scientific careers. Because a large number of highly qualified women applied, twenty-three women were accepted into Chatham's full-time, twelve-month, Program in "Industrial Chemistry with a Management Option". Of these 91% have either been employed or have entered graduate programs. A rough estimate of the additional federal income taxes which will be paid by these women in one year is $30 - $40,000. This additional revenue will cover the cost of the grant ($61,840) in 2 years or less.

The Chatham program is designed to update the participants backgrounds in chemistry and provide a basic background in management, computer science and technical writing. This was accomplished through course and laboratory work, workshops and internships, which are full time work experiences in industry. We feel the management portion of the program is of great value in providing the participants with a greater understanding of the corporate world and preparing them for careers in technically-related areas of marketing, sales, etc. It has also helped the women assess their potential and interest in the management area, an area in which women are severely under-represented. Vital to the success of the program is the support and co-operation of local industry and government agencies. This has been particularly important in providing internships, lectures in the industrial chemistry course, placement of the women, and many other activities. This co-operation has benefited the participants, Chatham College and the community.

In June of 1979, Chatham College received a $98,663 grant to continue and expand the program. Twenty-five women were accepted for full time participation and three for part-time participation. Future support for this and similar programs will assure that more women will enter scientific careers. The greatest need for future support will be for tuition and other participant expenses.

PROFILE OF THE PARTICIPANTS

The participants in the 1978 program were an intelligent highly motivated group of women. All but one woman had previous work experience in a technical position. Most had left employment to raise a family and had not worked for seven years or more. Most had degrees in chemistry (14), but some majored in other fields; biology (6), bacteriology (2), psychology (1). All had a substantial background in chemistry. Three had graduate degrees (2 with M.S. and one Ph.D.) and the rest either B.A. or B.S. degrees.

The women ranged in age from 23 to 48: most were in their 30's, and had received their degrees from 6 to 15 years before entering the program (see Table I).

TABLE I

Distribution of Participants According to years since last degree

Years since last degree	1978 Program Number of Women	1980 Program Number of Women
0 - 5	4	6
6 - 10	7	5
11 - 15	7	2
16 - 20	2	8
above 20	3	4

All twenty-three of the participants in the 1978 Program were U.S. citizens, three were foreign born and belonged to ethnic minorities, eighteen of the women were married, sixteen with children. Of the five single women, two were head of the household.

A number of the women had sought employment in technical fields without success prior to participating in the program. At least one had been told that her degree, received 15 years ago, "was worthless".

The 1980 program began January 6, 1980 with twenty-eight excited and enthusiastic women. Of these women, twenty one are married, and nineteen have

children. Seven women are single, and one is head of a household. Five participants represent ethnic minorities (2 blacks and 3 Asians). This group has only recently begun the program and shows much promise.

SUCCESS OF THE 1978 PARTICIPANTS

Of the twenty-three women who participated in this program 91% have been either employed since completing the program (18 women or 78%) or have entered graduate degree programs (3 women or 13%). The graduate programs entered are Masters Degree Programs in Chemical Engineering, in Industrial Hygiene and in Hospital Administration. One woman has already completed her Masters degree program and is now employed. All of those attending graduate school have received full scholarships to pay for their graduate education.

A recent nine month follow up survey (conducted in September, 1979) which was updated January 1980, of the 1978 participants reveals that the employment picture is quite fluid. Of the 18 women who have been employed in technical positions since completing the program, twelve presently are working full-time, with an average salary of $15,637 and a median salary of $17,350. 3 women are working part-time, one is self-employed, and one has opted for summer employment until her children are older, and one has left her job and is seeking a new position. Two women have already changed their employment to improve their situation. The table below indicates the type of employment these women have had since completing the program.

TABLE II

SUMMARY OF PARTICIPANT EMPLOYMENT

	TYPE OF EMPLOYER	POSITION	NO OF WOMEN	AVERAGE SALARY	NUMBER OF WOMEN WHO WORKED PREVIOUSLY
1.	Industrial Laboratory	Chemist	7[a]	$17,602	0
2.	Private Testing Laboratory or Quality Control Laboratory	Chemist, Technician	2[a b]	$11,150	2[c]
3.	University Laboratory	Chemist	1	$14,500	0
		Computer Programmer	1		
	Part-time	Chemist	2[d]		
4.	County Laboratory	Chemist Microbiologist	2[b]	approx. $12,000	2
5.	Instrument Company	Sales	1	$17,000	0
6.	Private Academy	Teacher (part-time)	1[d]		0
7.	Self employed	Started own business	1[d]		0

a. one position summer employment
b. one woman has left this type of employment
c. not in technical positions
d. income not included in salary average or median

As indicated in table II twelve of these women had not worked for several years before the program. Two were working previously but not in technical positions, and only two of these well educated and highly motivated women were working in technical positions before starting the program.

A rough estimate of the additional federal income tax which these women will pay in one year due to new employment or improved salaries is approximately, $40,000. This estimate is based on 1978 tax tables using a filing status of married filing separately, with one exemption. An estimate of $30,000 in increased federal taxes is obtained assuming a filing status of unmarried head of household with one dependent. Using that conservative estimate, the cost of the 1978 Chatham program of $61,840 would be paid for in two years or less, by increased federal revenues.

NATIONAL SCIENCE FOUNDATION SUPPORT

Without National Science Foundation support, Chatham would have not been able to establish and implement this tuition-free program, and the second grant was vital to enable us to expand and institutionalize the program and make it an ongoing program within the College. We are particularly pleased that this 1980 grant includes stipends for some participants. Continued support for the program and similar programs is crucial if women are to have equal opportunity for careers in scientific areas. Future support for the participants to cover tuition and other expenses is critical if the program is to continue and be available to those who need it most.

There is strong evidence for continuing need for the program. Interest in the 1980 program was greater than in the 1978 program. Both the number of enquiries and the number of applicants were higher for the 1980 program. It appears that there is a market for this type of program in the Pittsburgh area. Employment in chemistry is expected to remain strong at least through the mid 1980's. Women are severely underrepresented in the chemistry field. Therefore, the employment outlook for the participants in the program is good.

Senator METZENBAUM. Thank you very much, Dr. Kostalos.

Let me just bounce around some questions, if I may.

Dr. Reynolds, in your testimony you suggest that recent demographic changes in our population have contributed to these limited numbers of tenure positions available at universities. However, this would not explain why the rate of increase of tenured women faculties is less than the rate of increase for men.

Can you explain that differential?

Dr. REYNOLDS. There are lots of concerns there and they bother me deeply. We have just been reviewing those statistics ourselves. They are a little bit deceptive. We are losing tenured faculty women at the older associate professor and full professor levels. As was implied here today, there were a greater percentage and more absolute numbers of women getting doctorates in the twenties, thirties, and forties than there were in the fifties and sixties.

So when one looks at the full professor ranks, we are seeing a lot of distinguished women who were in academic fields go on to retirement. There is not a cadre of women in the 35- to 50-year-old age bracket to replace them because of many of the things we have heard here today. So we are looking primarily at increasing opportunities and increasing numbers of professional women at the assistant professor level moving into the associate professor levels. So it makes our statistics look even worse than they are.

But to get to the second and more important part of your question, why, with even this increase in women, aren't they making substantial inroads into academia.

They are in some fields; in others they are not. And there's another issue that has not been addressed here today which is that of mobility. We are seeing many more two-career couples and women still tend to move more with their husbands and not become permanently committed into the tenure track step movement. A husband who's in an academic field will move into a tenure track job; the wife will come along and remain for a long period of time as a lecturer/instructor. That's another component of it.

Senator METZENBAUM. Thank you.

I don't know which of the panel members might want to answer this question, but the bill creates another advisory committee at NSF and a new special assistant position. Do you think that's really necessary for the administration of the program?

Dr. MALCOM. I would like to respond to that question, please.

I have some familiarity with the National Science Foundation. I feel there is some difficulty with the implications that have come before, that the bill would, in essence, relate to programs that would be housed in science education, period.

While this may be true because of the focus on education and training, this cannot be—the sole responsibility cannot be given to science education. It must also be shared by the research directorates.

I will give you an example of this. Figures were quoted to us this morning in terms of the numbers of graduate fellowships and the proportion that went to women, and of the postdoctoral fellowships, the proportion that went to women. I would venture to guess, even though I do not know the source of these figures, that those are

figures from the graduate fellowship program and the postdoctoral programs within science education.

Now, while this is significant, most of the support for graduate students and for postdoctoral students does not stem from the science education directorate. It comes from the research directorates through research grants. And yet we do not have a handle on how many women are actually being supported by the predoctoral and postdoctoral traineeships that come through the research directorates.

I would venture to guess that they are much lower than for the men, because there is evidence that the patterns of financial assistance to men and women are different. Women would be more likely to have a teaching assistanceship rather than a research assistanceship, while the men would be more likely to have a research assistanceship than a teaching assistanceship. Until there is some mechanism for coordinating efforts across directorates, then you will have a problem.

I do not think that you can run a program by committee in the sense that you would have one person from each directorate responsible for the overall implementation of the program. That's why someone who is at the special assistant level and to the director, rather than being housed in any particular directorate, would be absolutely essential to the implementation of this bill.

Senator METZENBAUM. Thank you.

Ms. DUNKLE. I would like to add something to that.

Senator METZENBAUM. Let me ask you to answer another question at the same time.

Dr. Pimentel has just testified NSF is directing considerable effort to achieving equality of women in science. Do you and the groups that you represent think that NSF's efforts are sufficient? And can you put the two answers together?

Ms. DUNKLE. I'll try.

At this point we don't believe that the results of the efforts of NSF are sufficient, or that the efforts being made in enforcing the laws prohibiting discrimination are sufficient. The rather dismal situation of women students and women employees in science and technology is the result of subtle discrimination, of subtle bias and of overt discrimination. Therefore, additional efforts are needed in order to get the attention of employers so that they will focus on remedying the problem, in order to have educators address the problems more effectively, and in order to have people within the federal government who administer these programs be more aware of the special circumstance that women and girls often find themselves in. Employees, educators and Federal officials all need to come up with creative ways to address the circumstances.

Along that same line, I would like to stress how important it is to have an advisory committee or a special assistant whose prime purpose it is to focus attention on that issue. For example, in the vocational education amendments that you passed in 1976, reauthorizing the Vocational Education Act of 1963, you created, because of discrimination and bias against women in vocational education, an office for women in vocational education in each State. This office, staffed by a full-time person whose primary concern is equity for women in education, is the major reason that some

progress has been made in ending bias and discrimination in vocational education programs in the States. There was someone there constantly to call attention to the issues, to analyze programs and policies for their effect on women, to suggest remedies that were reasonable and to implement at the State level. This has made a tremendous difference.

Second, with regard to the advisory committee question, in the 1974 Women's Educational Equity Act an advisory council on women's educational programs was created.

With regard to education programs, this council has provided important analyses of the effects of Federal programs on women in education. It has shared that information and it has been able to identify alternative ways that the executive branch, the Office of Education (soon to be the Department of Education), can address these problems. It has provided information to educational institutions about policies and program that they could change. So they have made a big difference in terms of the development of information, the focus of information and the identification of constructive solutions to difficult issues.

So, while we applaud what NSF has done so far, we think that additional efforts are needed if we're really going to address the issue of bias and discrimination against women in science and technology seriously. We believe that the bill you have before you today makes a very, very good start on that.

Senator METZENBAUM. Dr. Kostalos, how do you account for the current discrimination of women in scientific fields despite the laws that prohibit discrimination in employment on the basis of sex?

Dr. KOSTALOS. I think in some ways they just plain get around them. For example, we have had a number of women applying for jobs and they have said "we only accept chemical engineers". There are very few women chemical engineers. When you really look at the job they're doing, the job could be done by a chemist or a biologist, or sometimes even a soc major or an English major. But by making the job description so specific to chemical engineering, where there are very few women, this is one of the ways. There are all kinds of things that go on.

I think some of the women have alluded to the "old boy" network, that when you're looking for somebody to fill a job you ask your friends. It is mostly males in positions to do hiring. They're asking their male friends. In general, the names that they get are names of males. When you have this type of situation, it is very understandable that males will be hired in place of females many times.

Senator METZENBAUM. Do you think we'll ever get to the "old girl" network? [Laughter.]

Dr. KOSTALOS. I hope so.

Senator METZENBAUM. In your opinion, Dr. Reynolds, why do many of our most prestigous research-oriented universities employ few, if any, full-time scientists?

Dr. REYNOLDS. Full-time women scientists?

Senator METZENBAUM. Women scientists.

Dr. REYNOLDS. Again, I go back a bit to what I said earlier. A very good example of a prestigious woman scientist, would be a

colleague of mine, Dr. Roslyn Yallo, who won the Nobel Prize. She did her doctorate back in the early forties at the University of Illinois at Champaign Urbana, because it was the only institution that would take women in a scientific field. But in her age bracket now—and she's a very young scientist in my opinion—in her age bracket there just are not very many women scientists. There are just not a lot of distinguished women scientists in the upper forties and fifties because of what happened in this country in earlier periods. It took incredible determination, flying against the face of societal values and everything else, to go ahead and become a scientist in the forties, fifties, and even the early parts of the sixties.

I think what we're facing now is creating more of these kinds of women. We must take the women who are already trained and make sure they have the research opportunities and the academic opportunities to become excellent women scientists who make major contributions. We must make sure we keep increasing the pool of women choosing to go into this field.

You talk about an "old girl" network. I am confident of the distinguished work and the real impacts being made by women scientists in my age bracket and above. Thanks to the support provided by the Federal Government, and particularly by the National Science Foundation and HEW, many women are making very important contributions to our scientific knowledge.

Senator METZENBAUM. My last question is to Dr. Malcom.

What unique problems do you see faced by minority women scientists?

Dr. MALCOM. I think there are problems that minority women scientists face that are unique to them. As a matter——

Senator METZENBAUM. Let me at the same time ask you to comment on whether or not you think there is a special advantage that minority women scientists may have in the endeavors, a kind of tokenism, where certain corporations are trying to find people to staff and to hold out what a great job they're doing? Just cover the whole subject, if you would, in your answer.

Dr. MALCOM. I think some of the problems are very similar, that it's a matter of the extent of the problem. Where a lack of role models is a problem for—may be a problem for all women in science, it is an even greater problem for minority women scientists, since the numbers are so much smaller.

I think there are strong cultural traditions which mitigate against the choice of career by minority women. As minorities, as well as by women, it is almost as though you receive that message stereophonically rather than monaurally. So that you're getting it from one side based on culture and maybe from another side based on sex role stereotyping.

In the case of Hispanic women and American Indian women, there may be additional language difficulties, the whole bilingual problem, that would interject itself as an additional barrier which must be overcome.

There is ofttimes——

Senator METZENBAUM. American Indian women?

Dr. MALCOM. Yes.

Senator METZENBAUM. With language difficulties?

Dr. MALCOM. Yes. Some tribes still hold to the older ways and still speak the native languages.

There is ofttimes unconscious exclusion from programs which are set up for women, because when people say "women," they think in terms of majority women rather than actually including minority women. For those of us who were trained in segregated schools—and there are still such things around—there are the difficulties of having been given an overall inferior education. In many cases, where the schools lack facilities, where they lack equipment, which may be afforded a school in the suburbs but may not be in some poor school within the inner city. There are these kinds of additional things which do serve as unique and additional barriers for minority women.

Yes, there are rumors around that, as minority women, we enjoy some kind of advantage in terms of employment, as being "twofers," that is, being able to be counted twice. If that's the case, I haven't seen it. I have had as many problems and maybe more in getting a job as anybody else has early in my career.

When I moved to the Washington, D.C. area I was unemployed, just like a lot of other people, for some time. I had heard all the rumors and had believed them, that as a minority woman scientist you had some kind of special in. Well, it's not true.

It is also true that minority women receive less money for the work that they do, so we still face these barriers and we enjoy no particular advantage by being able to be counted twice.

Senator METZENBAUM. Thank you very much.

Senator Schweiker?

Senator SCHWEIKER. Thank you, Mr. Chairman.

Dr. Reynolds, you're on the firing line of a big State university and have an opportunity to see a lot from that perspective. I guess my question is twofold.

No. 1, how much progress, in your judgment, for increasing the participation of women in science, have we made in the last decade, and specifically, what do we have to do in the next decade to be where we ought to go in this area?

Dr. REYNOLDS. You're asking me about women scientist faculty?

Senator SCHWEIKER. Yes.

Dr. REYNOLDS. In the last decade we have lost ground on the number of tenured women in the sciences at my institution. Again, that's because women in the senior ranks have now moved into retirement. We had more, a higher percentage of women in those ranks some years ago than we did through the sixties. Few women were trained in the late forties through the fifties. So there is a real gap there.

With respect, however, to the assistant professor level, moving into the associate professor level, we are making pretty good strides. For example, in the last 3 years that cohort has gone up about 10 percent, 10 percent more women in that level than there were before. These are tenured women. We have increased at the lower level.

In Big Ten universities, and in the first-class west coast and east coast and southern and northern universities, there is an eagerness to recruit women. But they still must prove themselves. It's not enough just to complete graduate school. That's why I feel so

strongly that some additional impetus is needed. We could help move women into first rank, prestigious universities by taking positive actions to provide startup research funds for women trying to enter the competitive system.

Senator SCHWEIKER. I understand we have had some previous testimony indicating that there's a difference here, depending on what kind of institution and environment you're talking about. So maybe I should ask the same question of Dr. Kostalos.

How would you respond from your perspective at Chatham to both of those questions? Where have we made progress, if any, in the last decade, and where should we be looking and working in the future, in the next decade?

Dr. KOSTALOS. Well, unfortunately, the situation isn't really any better at small women's colleges——

Senator SCHWEIKER. Why is that?

Dr. KOSTALOS. Well, partially the same reason at Chatham, the only two women full professors have retired in the last 5 years and there just isn't anybody to replace them. We have women assistant professors and we have women associate professors, and probably in 5 or 10 years we will be able to move some of those women up to the full professor rank. The situation is exactly the same in a small college on a much smaller scale, very similar to that of Ohio State. That's the answer to that one. It's exactly the same.

In terms of what we have to do, I think I would tend to agree that all of the things that have been suggested would be useful. I think the NSF has done some very good things, and I think our program is an example of that. But it's one very small program which has reached fewer than 60 women at the present time. There are so many more women out there who need this kind of additional help.

I fully support the idea of additional research money for young women scientists coming out of graduate schools. It can be a very competitive situation and again, one in which I think men often tend to be favored. So I think additional money there would be very, very useful.

Senator SCHWEIKER. Now, getting back to your specific program at Chatham, it's a 12-month program as I understand it; is that right?

Dr. KOSTALOS. That's right. It's 1 full calendar year.

Senator SCHWEIKER. And do the students get credit for advanced degrees in the program or not?

Dr. KOSTALOS. No, this is not a degree program. These are for women who already have degrees. This is an updating program which aims to bring their knowledge up to that of a current graduate, plus giving some special edge by giving them additional training in management, computer science, and technical writing.

Senator SCHWEIKER. So they wouldn't get any credit toward a master's?

Dr. KOSTALOS. No.

Senator SCHWEIKER. Most people who participate in the Chatham program do have a bachelor's degree, is that correct?

Dr. KOSTALOS. That's right. They had to have a bachelor's degree. There were few people with master's degrees, and one or two women with Ph. D.s. The Ph. D. women tended to have been

foreign-born women who were having trouble in establishing careers in this country.

Senator SCHWEIKER. In a nutshell—and I realize this is the center of the program—what is the advantage of retaining that way as opposed to these same kind of people just plugging in to regular programs and trying to go back to, say, pick up a master's without this kind of a transition program?

Dr. KOSTALOS. I think the big thing our program can offer is the updating. You're talking about a woman who may have been out of school for 5, 10, 15, or 20 years, and her background needs to be updated. You throw her into a graduate program with equipment that she has never seen before, expecting her to use a computer which she may have never seen before, use analytical equipment which she is not familiar with, and she's going to be at a very great competitive disadvantage with students coming out of undergraduate programs who have had this kind of experience.

We feel the updating is very, very important for these women. The alternatives for these women would be to go back to undergraduate programs again and retake courses just to get their background up to snuff. To do this would take them 2 to 3 years as opposed to the 1-year program we offer at Chatham.

Senator SCHWEIKER. Now, what about the undergraduate program at Chatham? In other words, what kind of undergraduate science education program do you have and how many students graduate with some science degree?

Dr. KOSTALOS. Chatham is quite a small college. It has an enrollment of slightly over 600 at the present time, so these numbers are going to sound fairly small.

Chatham has a very good science program. It is one of the few small women's colleges which is ACS accredited—that's the American Chemical Society—and this is in addition to the Middle States accreditation that Chatham College has. So it has an excellent program in chemistry. The majority of chemist majors do go on to graduate or professional schools.

In looking at biology and chemistry together, about two-thirds of our young women who wish to go to professional school, medical, dental, or veterinary schools get in, and this compares to about one-third on the average. So we are quite pleased with our science program. We don't graduate that many people, usually 10 to 15 biology majors graduate and 2 to 3 joint majors with the chemistry department. The chemistry department graduates probably 2 or 3 majors a year, most years.

One of the big things the women in science program has done for Chatham College is to allow us to use our equipment much more efficiently. We have a tremendous amount of equipment in the chemistry department which was not being used because of the very small classes. Bringing these women in has allowed us to make good use of this very large capital investment that we do have in equipment.

Senator SCHWEIKER. One perspective, of course, is bringing people back to continue their education and go on from there, which your program is designed to do. How do you assess the problems of women who are not actually going back but are going through the system right now. You can comment not just from

your Chatham college point of view which you just described, but in general. What do you see happening in terms of attracting women and encouraging them to stay in that bachelor's program in science?

This is aside from your school. I realize you're sort of a special case somewhat.

Dr. KOSTALOS. Well, I think many people have alluded to some of the things. It starts way back in grade school and works its way on up. If a girl has not had the appropriate science and math courses in grade school, junior high school and high school, she is very ill-equipped to enter a bachelor's program in science at the college level. She either needs to take remedial work or really struggle. In many cases they just drop out.

So I think it starts before college. If you're going to attract young women into our bachelor's level programs, they have to have the high school background to enable them to enter science degrees or go into science degree programs when they get to college.

Senator SCHWEIKER. Dr. Reynolds, are there any uniquely different problems in dealing with the same thing at Ohio State, in terms of attracting women into the undergraduate science programs?

Dr. REYNOLDS. No, I don't think so. We are very concerned in the entire State of Ohio with enabling our young people to get the required English and math courses before they reach college. We spend an inordinate amount of time, effort, and money on math and English remediation at the college level. Women historically test lower in mathematics and have taken less of it.

I have a small daughter and you work with the Girl Scouts and you can get the impression very quickly that sociologically math is just not a popular thing for girls in junior high and high school.

This bill looks at that a bit and addresses that. I applaud that endeavor. We have to work much more on younger women with respect to understanding the appeal, the wonderment of science, and we have to convince them at that level in order to recruit them into science programs in college.

Senator METZENBAUM. Thank you, Senator Schweiker.

I have been very impressed with the testimony this morning. I think it has zeroed in on these issues. I came to this hearing and am frank to say I came with a rather open mind, kind of an objectivity, and not knowing whether I was really for or against the bill.

I think the bill has much merit, and the $25 million involved can be found by taking that out of other NSF programs without imbalancing the budget. As a consequence, I will become a cosponsor of the legislation with Senator Kennedy and perhaps we can move it forward more rapidly.

At this point I order printed all statements of those who could not attend and other pertinent material submitted for the record.

[The material referred to follows:]

STATEMENT IN SUPPORT OF S 568
the "Women in Science and Technology Opportunity Act"

Submitted to the
Subcommittee on Health and Scientific Research
by the Women's College Coalition

WOMEN'S COLLEGE COALITION

Suite 1003 1725 K Street, N.W. Washington, D.C. 20006 (202) 466-5430

The Women's College Coalition is pleased to submit this statement in support of S.568, the "Women in Science and Technology Equal Opportunity Act."

The Women's College Coalition is a voluntary organization representing the nation's undergraduate colleges for women. (See attachment A.) Its members include public and private institutions, independent and church-related colleges, and two and four year institutions. While representing only a small minority of the nation's colleges and universities -- roughly 125 institutions among 3,000 -- women's colleges are widely recognized as playing a role in the advancement of women far disproportionate to their numbers.

As Patricia Roberts Harris, Secretary of the Department of Health, Education and Welfare, noted at the September 1979 "Secretary's Conference on Women's Colleges," the colleges "have educated distinguished women out of all proportion to their numbers or their endowments: women who have become leaders in government, the professions, and education, in the nation's religious and artistic life."

Nowhere has this leadership role been clearer than in the sciences.

- With respect to the tendency of undergraduate women students to major in the sciences, numerous studies have shown that women's college students major in the sciences at roughly twice the rate of women in coeducational institutions. (See Newcomer, 1959; Women's College Coalition, 1977; and also Astin, 1979).

- With respect to the productivity of achieving women scientists, at the post-baccalaureate level, women's colleges have again been shown to outpace all other

institutions in producing graduates who subsequently obtain research doctorates in the physical sciences and in engineering. (Tidball and Kistiakowsky, 1976; See Attachment B).

- And in terms of the encouragement of today's women students and women teaching faculty in the sciences, the women's colleges stand without peer. A 1979 study of the involvement of women's colleges in biomedical research activity showed that 54% of the total faculties, in the biomedical sciences, at women's colleges were women; that 51% of all full-time faculty in the biomedical sciences were women; that half of all the science faculty receiving external funding for research at women's colleges were women; and that 61% of all the women faculty at women's colleges in the biomedical sciences were involved in research participation and/or training with undergraduate students. (See Attachment C to this statement)

The following comments in support of S.568 are made in the context of the commitment to the advancement of women in science, that the above figures imply.

In general, women's colleges strongly support the underlying assumption of this bill -- namely that unified and focused action, at the federal level, is necessary to overcome the barriers to the full participation of women in scientific life that now so clearly exist.

With respect to the specific provisions of the bill: it should be understood that women are fairly respectibly represented in the total of those who earn doctoral degrees in the sciences -- women constituted, for example, 23% of all biomedical research doctorates during the period 1973 to 1976. Women are, however, far less respectably represented in tenure tracks at the nation's colleges and universities, and in principal investigator statistics. Any proposed national program to bring about the

advancement of women in science must, therefore, address itself to the goal of getting more women into what can be called the science "establishment." The word establishment is meant to suggest these needs: getting more women into tenure positions in higher education; getting more women as principal investigators on research grants and awards; getting more women on peer review committees for grant applications; and in general, making women more competitive as grantees, consultants, and intramural scientists.

To make women more competitive, there are two lines of action required:

- To attract greater numbers of women into the science "pipeline," on the theory that this will increase the real numbers of women who meet success, even if not the relative chances for success; and

- To open up the paths of advancement (contacts, mentors, access, tenure) to those in the "pipeline."

We applaud the features of the proposed bill which would work towards that first goal of attracting greater numbers of women into scientific study and career. In particular, we cite the activities reaching down to the elementary and secondary levels of education, and the creation of the Center for Women in Science. We are further pleased to see the attention devoted to public education efforts.

With respect to the second line of action cited above -- namely that of opening up the paths of advancement to women scientists -- we wish to make several points.

- The Visiting Professorships for Women in Science, outlined in section 413 (a) are extremely important and deserve to be fully supported. This program will have a dual impact, in that it will give the women who are selected for the professorships the prestige and credibility that such designation

can provide, and at the same time expose women students to dedicated and achieving women science professionals. In fact we urge that the money that is proposed for the "Women and Science Incentive Awards" be used instead for additional support for this program. We further recommend that the grant funds to support the visiting professorships be awarded to the professors, rather than to the institutions. Finally, we hope the Congress will not fall into the mistake of permitting the visiting professors to serve only in the (often hostile) departments of institutions "where women are seriously underrepresented." Women's colleges, for example, have strong representation of women in their science departments. They also have the climate of affirmation for women * as do the teachers and learners - that would make this Visiting Professor program most effective and most highly leveraged.

- Under the Higher Education Programs (section 202a) we urge that the activities to be supported which relate to traineeship and fellowship opportunities for women in science and technology be construed in such a way that faculty members are fully eligible, as well as students.

- Under the proposed Demonstration Projects (section 412) the Foundation is presently authorized to support, among other activities, "the establishment and implementation of cooperative research and education arrangements between business concerns and academic institutions." We applaud this initiative and further urge that the Foundation also

fully and specifically support cooperative arrangements between different kinds and levels of higher education institutions. As indicated above in the material on women's colleges, it is often the self-standing undergraduate teaching institutions that have the strongest records and the greatest experience, at the post-secondary level, in encouraging women to undertake baccalaureate studies in the sciences. These institutions do not, however, always have the relationships with graduate and research institutions that can best provide their students with the post-baccalaureate experience (including research opportunities and informal mentoring) that are needed. Linkage projects designed to bring together undergraduate and graduate research institutions in consortial and other relationships are strongly needed to advance women in science. They should be specifically supported under this section of the bill.

- The task of getting more women into the ranks of those with principal investigator status in federally and privately supported research must be taken as a high goal of this proposed program. We are pleased to see that one of the functions of the proposed Committee on Women in Science is to "provide advice concerning the appropriate manner to increase the number of women principal investigators on research projects." We are, however, guardedly optimistic about the real authority and capacity of this Committee, with respect to this laudable goal. We urge, therefore, that the strongest possible language be built into those portions of the

proposed bill which relate to the Annual Report, detailing progress in this and other areas, which the Director of the National Science Foundation is charged to submit to Congress.

We appreciate the opportunity, on behalf of Women's Colleges to express our support of this important bill.

Marcia K. Sharp
Director
Women's College Coalition

February, 1980

WOMEN'S COLLEGE COALITION

Suite 1003 1725 K Street, N.W. Washington, D.C. 20006 (202) 466-5430

Fact Sheet

The Women's College Coalition is a voluntary organization of 67 women's colleges nationwide. Members come from 24 states and the District of Columbia, and include public and private, independent and church-related, and two and four-year colleges.

Purpose The Coalition functions as an advocate and information resource for women's colleges. It is primarily concerned with examining ways in which women's colleges work within the education community to support the intellectual, professional and personal development of women today.

Through a research project supported by the Ford Foundation, the Coalition is working to develop a data base on the country's undergraduate colleges for women. The Ford project also supports the Coalition in functioning as a clearinghouse for research studies that have significant bearing on women's colleges, and as a repository of materials on women's colleges.

Topics of particular interest to the Coalition include:

- the role of women's colleges as resources on women and women's affairs;
- curricular focus on women/women's studies;
- women's athletics;
- advancement of women in teaching, administrative and trustee positions;
- public policy concerns of women's colleges.

Organization The Coalition was founded in 1972 as a project of the Association of American Colleges. It is funded by its member colleges and governed by an Executive Committee of nine member Presidents, headed by Dr. Rhoda M. Dorsey, President of Goucher College.

For Further Information Contact Marcia Sharp, Director, or Susan Nall Bales, Research Coordinator.

August 1979 — *A Project in Cooperation with the Association of American Colleges* —

WOMEN'S COLLEGE COALITION

List of Member Colleges

California
- Mills College
- Mount St. Mary's College
- Scripps College

Connecticut
- Albertus Magnus College
- Saint Joseph College

District of Columbia
- Trinity College
- Mount Vernon College

Georgia
- Agnes Scott College
- Spelman College

Illinois
- Barat College

Indiana
- Saint Mary-of-the Woods College
- Saint Mary's College

Kansas
- Saint Mary College

Kentucky
- Midway College

Maryland
- College of Notre Dame of Maryland
- Goucher College
- Hood College

Massachusetts
- Bay Path Junior College
- College of Our Lady of the Elms
- Emmanuel College
- Mount Holyoke College
- Pine Manor College
- Radcliffe College
- Regis College
- Simmons College
- Smith College
- Wellesley College
- Wheaton College

Minnesota
- College of St. Benedict
- College of St. Catherine
- College of St. Teresa

Missouri
- Stephens College

Mississippi
- Mississippi University for Women

New Hampshire
- Colby-Sawyer College
- Rivier College

New Jersey
- Caldwell College
- College of Saint Elizabeth
- Douglass College, Rutgers University
- Georgian Court College

New York
- Barnard College, Columbia University
- College of New Rochelle
- Keuka College
- Maria Regina College
- Marymount Manhattan College
- Russell Sage College
- Wells College
- William Smith College

Ohio
- College of Mount St. Joseph on the Ohio
- Lake Erie College

Pennsylvania
- Bryn Mawr College
- Carlow College
- Cedar Crest College
- Chatham College
- Chestnut Hill College
- Marywood College
- Moore College of Art
- Rosemont College
- Villa Maria College

South Carolina
- Converse College

Vermont
- Trinity College

Virginia
- Hollins College
- Mary Baldwin College
- Marymount College of Virginia
- Randolph-Macon Woman's College
- Sweet Briar College

Wisconsin
- Alverno College

Texas
- Texas Woman's University

1979

APPENDIX B: REPORT OF THE WOMEN'S COLLEGE COALITION SURVEY OF BIOMEDICAL RESEARCH ACTIVITY IN UNDERGRADUATE WOMEN'S COLLEGES

A survey instrument (see attached) was developed by the Biomedical Research Opportunities for Women (BROW) Work Group to provide the study group with information regarding current biomedical research activity at women's colleges. The questionnaire was mailed in early March to member presidents of the Women's College Coalition, a voluntary organization of 67 women's colleges nationwide. Presidents of the institutions were asked to obtain relevant data from department chairs in the following fields: biology, zoology, botany, biochemistry, organic chemistry, and chemistry. Of the 66 institutions surveyed, 4 were later judged to be inappropriate to the study since they are two-year institutions. Of the remaining 62, 46 or 74% responded to the survey. 19 of the institutions responded for two separate departments giving a total of 65 departments represented in the findings. The sample comprises independent and church-related institutions, urban and rural, highly selective and less competitive, large (over 2,000) and small (under 500) institutions nationwide.

The study revealed that women faculty members at women's colleges were typically full-time faculty members (73%) involved in research projects (45.3%) and in research participation/training with undergraduate students (61%). Approximately 4.6 women students in each department responding are engaged in research with faculty, and an average of 2.8 women faculty at each department are working with women students on research projects. Significant publications activity was reported by a number of the colleges. Of those women faculty engaged in research, 41.2% are involved in collaborative activities with colleagues. Relative to their enrollment size (which is typically small), the responding institutions show a healthy percentage of student majors in the biomedical sciences.

Some highlights from the survey are outlined below:

- Women constituted 54% of the total science faculties of responding institutions, 51% of the full-time faculty and 66% of the part-time faculty
- 64% of all women faculty at these institutions held earned doctorates
- 51.1% of the faculties at women's institutions are engaged in research activities and nearly one half (48.5%) of those so engaged are women
- One half of those faculty receiving external support for research (14.7% of the total faculty) are women
- 18.7% of all women faculty are engaged in collaborative research
- The average department size for a responding institution was 4.9 full-time faculty and 1.3 part-time faculty members
- 61% of the women faculty are involved in research participation/ training with undergraduate students

AWIS

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TESTIMONY ON S.568

"WOMEN IN SCIENCE AND TECHNOLOGY EQUAL OPPORTUNITY ACT"

SUBMITTED BY

THE ASSOCIATION FOR WOMEN IN SCIENCE

TO THE

SUBCOMMITTE ON HEALTH AND SCIENTIFIC RESEARCH
OF THE
SENATE COMMITTEE ON LABOR AND HUMAN RESOURCES

MARCH 3, 1980

Senator Kennedy and members of the Committee:

The Association for Women in Science appreciates this opportunity to present its views regarding S.568, the "Women in Science and Technology Equal opportunity Act."

The Association for Women in Science

The Association for Women in Science is a non-profit organization dedicated to promoting equal opportunities for women to enter the professions and to achieve their career goals. The women's rights and civil rights movements, a growing awareness of the magnitude of sex discrimination in the professions and personal experiences of unequal opportunities led to the founding of AWIS in 1971 by a group of bioscientists. Since that time, AWIS has become a national organization with members from all fields in the physical, biological and social sciences, and related professions. AWIS welcomes as members all individuals, men and women, who share its aims.

AWIS has been a leader in efforts to achieve enforcement of equal opportunity legislation. It cooperates actively with other professional societies in efforts to improve the status of women in various fields. AWIS has a registry containing the names of over 5000 women scientists, which serves as a clearinghouse for employers and provides candidates for NIH committees and search committees. AWIS publishes a newsletter to provide communication among women scientists and has chapters nation-wide which bring women scientists together to provide mutual support and assist career development.

Sex Discrimination in Science and Technology-A continuing Problem

That women in the United States have been denied equal opportunity in scientific and technological careers has been extensively documented. 1/ Women make up less than 10% of scientific researchers in this country. This exclusion is of long standing; in some fields of science, women received a higher proportion of doctorates awarded in the 1920s' than they did during the 1960s'. Women in science are still disadvantaged relative to men:

> The salary gap between men and women in science persists, especially at more advanced stages of careers.
>
> Women scientists continue to show rates of unemployment which are several times those of men.
>
> Women scientists continue to be underrepresented in tenured positions in the universities and colleges, and there has been no significant improvement over the past several years.

A fundamental problem underlying many specific obstacles to women in science is the perception of science and technology as masculine fields, which are not suitable for women. This perception results in societal attitudes and practices which discourage young women from undertaking careers in science, and which lead to discriminatory barriers for those that do pursue careers in science which often prevent them from making full use of their talents. In combination with the many pressures which women face because their role in our society has traditionally been defined primarily in terms of their domestic roles, the resulting discriminatory attitudes creates a special set of problems for women in science.

This situation is most unfair to the many women with abilities and interest in scientific fields. It is also wasteful of our human resources. Steps are needed to change the situation as rapidly as possible. For without active programs, so longstanding and deeply ingrained a set of prejudices and policies as those which discriminate against women in science are unlikely to change.

Reactions to S.568

The Association for Women in Science wishes to express its strong support for the "Women in Science and Technology Act". A primary reason for our strong support of this legislation, apart from the great need which exists for programs to address the problems of women in science, is the fact that this legislation is so well designed to deal with the special problems which face women in the sciences. We strongly support the statement of findings, declaration of purpose, and statement of policy because they have addressed the specific problems whcih women face as a result of their position in our society.

Negative attitudes towards women's participation in science and technology have an early impact, and discourage girls from pursuing courses of study necessary for a science career, such as mathematics. In Section II--Education, a number of excellent proposals are made to deal with this problem. The schools, through their choice of course materials, staff attitudes, etc. often contribute significantly to the societal pressures which tend to keep women out of science. These programs, and especially the inclusion of provisions for efforts at the elementary school level, should provide valuable support for changing these attitudes.

We applaud such provisions as the awarding of fellowships and career development grants without regard for when an individual received an undergraduate degree. Training programs in the sciences have been designed on the assumption of male career patterns. Because women are more likley to suffer

interruptions in the pursuit of their careers, it is important to eliminate provisions, which discriminate against those with breaks in their careers, such as age limitations on financial awards, and to encourage practices which will limit the necessity for career breaks for women, and provide them with conditions for study and work which will permit them to follow their careers with a minimum of disruption.

We also strongly support the provisions to encourage women who have suffered interruptions in their careers to continue their studies. It has been estimated that as many as 600,000 women today have degrees in science and technology which they are either unable to use or which they are not fully utilizing. Many of these women dropped out of the scientific workforce for various reasons, and are now unable to return without some retraining. That they can return, given proper opportunities for training and supportive services, has been demonstrated by the NSF reentry programs. But these are on a small scale, relative to the need. One great value of this bill could be its encouragment of such programs on a far wider scale, with the support of the educational and business communities.

We also applaud the recognition of the special needs of minority women and handicapped women. Programs aimed at these groups have often overlooked the fact that they include many women, and that they have special needs because they suffer the double burden of discrimination as women as well as on other grounds.

The bill is also strong in its emphasis on outreach, and on cooperation with other groups. We believe it is important to such programs to have the active involvement of concerned groups of women, and also of the institutions which must ultimately change if solutions to these problems are to be found. Thus the involvement of educational institutions and of business and industry is important, and the bill should encourage this.

We also support the concept of a center for women in science in the NSF. While we would not want all programs for women concentrated in one organizsation, its presence should provide a focal point and motivating force for programs to encourage women in science and technology.

The bill is least strong in its provisions for assistance to women who are already embarked on scientific careers. However, there are some valuable provisions here also, for example, the provisions for gathering of statistics, and the awards provisions.

Summary of AWIS views

In summary, we believe that the need for action to encourage greater participation of women in the sciences has been amply demonstrated, and that this bill can make a significant contribution through its provisions for dealing with these problems. We especially commend the care with which it has been designed to deal with the special problems facing women in science as a result of their status in our society. We strongly urge that the congress pass this legislation.

Note

1) A. M. Briscoe & S. M. Pfafflin (Eds.). Expanding the Role of Women in the Sciences. Annals of the New York Academy of Sciences, Vol. 323, 1979; National Academy of Sciences. Women Scientists in Industry and Government; How Much Progress in the 1970s'?. Washington, D.C.: NSF, 1980. J. A. Ramaley (ED.). Covert Discrimination and Women in the Sciences. Boulder, Colo.: Westview Press, 1978; V. Kistiakowsky. "Women in Physics: Unnecessary, Injurious, and Out of Place", Physics Today, February, 1980, pp. 32-40. These sources are a sampling from an extensive number of studies which have documented the discrimination which women in science face.

Testimony on

Women in Science

by

Herman Feshbach, President, The American Physical Society

The American Physical Society is an organization founded in this country in 1899 for the advancement and the diffusion of the knowledge of physics. The society, now comprising some 30,000 members, organizes technical meetings, publishes the world's prominent physics literature, and operates other programs to serve this objective. By dedicating itself to its original purpose, the Society has been able, throughout its 80 years of responsive leadership, to put timely issues affecting the discipline and physicists in a proper perspective for action.

I speak to you today on an issue which the Society has recognized as seriously affecting its attempts to advance and diffuse the knowledge of physics. This is the presently low proportion of women pursuing physics as a career. Only 700 of the physicists holding Ph.D. degrees in this country are women. The number of women choosing physics as a career is increasing, but these are small increases in small numbers. The National Research Council surveys of doctoral scientists and engineers show that the percentage of physicists who are women has grown from 2.1% in 1973, to 2.5% in 1975, and 2.7% in 1977. The overall status of women in physics is seen to be even worse than these statistics indicate. Those women who are physicists, who have overcome the obstacles that have stopped the vast majority, receive significantly lower salaries, serve in positions of lesser rank, and experience 5 times higher rates of unemployment than their male counterparts.

The American Physical Society's Committee on the Status of Women in Physics was established in 1971. From its inception, its charter has been

to work on behalf of the community of women in physics and has not been restricted to activities on behalf of members of the Society. The Society has supported the work of the Committee and endorsed its activities because it feels that it can thereby identify and remedy some of the problems which face women who might or have considered physics as a career. We do not believe that the numbers of women in physics truly reflect the number who might well have become physicists: those who, finding their talents developed by the necessary education in mathematics and science and their opportunities commensurate with the capabilities, would have made that choice. The Society is convinced that more highly qualified people are needed, not only in physics but in all the sciences. We do, indeed, live in the age of technology. The women of this country are a valuable, national resource, a reservoir of talent, which must not be wasted.

The achievement of equal opportunity for women in science and technology presents two major challenges. As is generally agreed, the early influences which discourage girls and young women from pursuing the appropriate academic studies must be counteracted. The other challenge, for which the strategy is even more difficult to define, is that of securing for women equal opportunity to pursue the careers for which they are prepared. An attempt to achieve either one of these objectives without the other is unlikely to be effective.

To counteract disaffection with mathematics and science curricula, innovative educational programs at every level are necessary. It is especially crucial that women, in childhood and when they are mature, receive the counseling and advice which will bring them into these traditional academic studies that are essential for careers in science and technology. Promising results have been achieved with a variety of pilot programs. We urge that the scope

and number of such programs be increased through federal support and encouragement.

Encouraging a larger proportion of women to pursue mathematics and science studies, however, would be inappropriate and the effort would be doomed to failure unless the implied commitment to real equality of opportunity in subsequent career development is met. Failure in this regard is especially serious because it has the effect of crippling two generations: the women who are thereby unemployed or underemployed and the younger women for whom they would have set an example. Active efforts to recruit and promote women at every stage of scientific career development are necessary. Mere passive non-discrimination is insufficient to overcome long ingrained habits and attitudes on the part of women and their scientific colleagues. Incentives to encourage wide-spread voluntary cooperation may be the only viable approach to meet this challenge.

We offer the following specific suggestions related to some of the existing programs and to programs which would be established under the proposed legislation.

(1) Programs designed to attract girls and women to science and engineering careers should start at the junior high school level or earlier.

The environmental factors which influence girls' attitudes toward sciences and mathematics begin at an early age to limit the realization of their innate capabilities. Scores on mathematics tests show that the performance of girls relative to that of boys has already begun to decline at the junior high school level. The junior high school period is particularly

critical, moreover, because it is during this educational phase that all students decide whether or not to continue in the full sequence of mathematics and science courses. The percentage of girls presently taking these courses in high school compared to the percentage of boys is quite small and must be increased if greater proportions of women are ultimately to enter science and engineering careers. We stress the need for enlightened counseling so that girls do not compromise the choices they may wish to make when they are older.

(2) Scientific criteria for existing fellowship programs and for awards recognizing distinguished achievement should be carefully reviewed and modified so that women in mid-career will be able to compete on an equal basis, taking into account interruptions in their careers for family responsibilities as well as slower career development arising from past discrimination.

A variety of factors, including past discrimination, have hampered the career development of most women scientists and engineers. They lag behind their male counterparts in salary, in employment rank and grade, and in professional status. Because competitive advantage in science tends to be cumulative, so that those who forge ahead early tend to enjoy an increasing competitive advantage later in their careers, it is important that unnecessary penalties not be attached to slower career development. The selection criteria for most current programs have been predicted on the traditional career-development time sequence for men, putting women at a competitive disadvantage. Modifications of criteria, such as those presently stipulating chronological age limits or years since the highest degree, should serve to make more women

eligible to compete in these programs. The resulting opportunities for competent women and the visibility they would thereby achieve would assist women in realizing their full potential as productive scientists and engineers and would set a very important example for younger women and girls aspiring to scientific or engineering careers.

(3) The amount of paper work and reporting should be kept to the minimum necessary to gather essential information about the status of women in science and technology.

In addition to burdening and alienating administrators, excessive record-keeping and reporting requirements divert resources and funds from the major goals of programs designed to solve problems. Emphasis should be placed, instead, on streamlining the data-collection and dissemination procedures. A single reporting format and a congruent data base should be established with due consideration for the diverse requirements of the various federal agencies. The burden of repetitious reporting should be minimized by inter-agency transfer of necessary information.

(4) Distinguished EEO Achievement awards should, to the greatest extent possible, serve two major objectives: to give recognition to those individuals most directly responsible for fostering the careers of women scientists and engineers, and to enable the recipients to expand their research opportunities substantially.

The criteria for distinguished achievement awards should emphasize the employment of appreciable numbers of women scientists and engineers in positions of responsibility and in positions which offer opportunities for professional growth and advancement. In universities, these should be specifically tenure-track positions. Supervisors in government laboratories should be eligible,

as well, for recognition of their roles in creating a climate for the healthy growth and development of the careers of professional women. We believe that recognition, coupled with substantial cash awards, will provide powerful incentives to responsible individuals to devote themselves wholeheartedly to securing equal opportunity for women in the pursuit of careers in science and technology.

Although we have concentrated our comments in those areas in which our detailed experience is greatest, we offer these suggestions in the spirit of inclusion rather than exclusion. We support wholeheartedly the goals and objectives of the proposed legislation and recognize the need for a multifaceted approach toward achieving these aims. We hope that the provisions of the legislation will be implemented in the same spirit. We are aware that women would be badly served by legislation written in the "line item" philosophy, with a specific remedy to each problem presented by every special interest group. Too often, this allows those who must implement a bill's provisions to limit themselves to that which is specifically mentioned, avoiding responsibility for any problem not explicitly included.

We believe that legislation, embodying the philosophy that women, properly trained and employed, are a valuable and necessary resource to mankind and this country, will be a credit to the Congress, will advance the scientific disciplines and strengthen their ancillary technologies, and will inspire, guide, and foster the women who will enter such professional training and careers.

Department for Professional Employees, AFL-CIO
815 16th Street, N.W., Washington, D.C. 20006 Phone 202/638-0320

January 10, 1980

Honorable Edward M. Kennedy
Chairman
Senate Subcommittee on Health
and Scientific Research
4220 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Senator Kennedy:

The Committee for Salaried and Professional Women of the Department for Professional Employees, AFL-CIO, would like to provide you with its views on your bill S. 568 - the Women in Science and Technology Equal Opportunity Act.

As we read the bill, we understand it to have three general purposes. They are to:

- reverse the aversion of girls at the elementary and junior high school level to the study of mathematics and science,
- increase their literacy in mathematics and science, and,
- increase opportunities for women in higher education, business, and industry in fields requiring a background in mathematics or science.

We are wholly in accord with these objectives and believe that your bill establishes imaginative and useful programs which should be effective in achieving these objectives.

However, it is our belief that with relatively few changes the legislation could be substantially improved and the number of women who could benefit from its provisions would be increased many times. Specifically we would recommend that S. 568 be amended as follows:

First that the scope of the bill be extended to include the education and training of females for crafts, trades, and technical occupations requiring a background in science or mathematics. Among a few of the occupations which we have in mind are electricians, machine repair persons, draftspersons, computer programmers and technicians, electronic technicians, surveyors, and engineering assistants. The education and training involved would include one or more of the following: apprenticeship, on-the-job training, or vocational education at the secondary school or junior college level.

Another change which we believe would be highly desirable would be to make explicit what we believe is implicit in section 203 of the bill, namely that the program of continuing education contemplated by the section is intended for women at all educational levels, including those without previous mathematics or science education as well as those who have such an educational background. Additionally, that women would be eligible to participate in the continuing education program whether they are employed, underemployed, or unemployed. And that the continuing education program is intended to qualify women for advancement and better paying positions as well as for careers in different occupations.

Still another change which we believe should be made in the legislation would be to utilize the resources of the labor movement to achieve its purposes. Although this may have been intended, it would seem to us to be useful to specifically include union counselors and labor educators among those who could receive training in order to advise women in the labor movement of educational and job opportunities in the various scientific and technical fields.

Many women with substantial family responsibilities are able to work and contribute to their families' support through part-time work or job sharing. But the discriminatory treatment which many of these women experience by virtue of working less than full-time is substantial, including diminished -

- rates of pay and pay increases,
- opportunities for promotion, and
- fringe benefits.

Our final proposal is to include provisions in S. 568 which would deal with these problems within the scope of the bill, perhaps through an amendment to section 401(a).

For your information, the Committee for Salaried and Professional Women is one of the four standing committees through which the Department for Professional Employees (DPE), AFL-CIO carries out many of its functions. The Committee was established in 1974 and is made up of representatives from the member unions of the DPE. Those affiliated unions are 26 national and international labor organizations which include in their membership over one and one half million professional and technical workers. These workers are engaged in every major profession and countless technical occupations. There is attached a list of the unions which are members of the DPE, a policy statement of the Department regarding working women, and an excerpt entitled "Women in the Professional Labor Force" from Professional Workers and Unionization: A Survey, by Martin H. Dodd which was prepared for the Department.

We hope that this statement of our views will be helpful to you and would appreciate having them included in the hearing record on S. 568.

Sincerely,

R.W. Hackler

R.W. Hackler, Co-Chair

Gloria Johnson

Gloria Johnson, Co-Chair
Salaried and Professional Women's Committee

JG:RWH/jk

AFFILIATES OF THE DEPARTMENT FOR PROFESSIONAL EMPLOYEES

Actors Equity Association

American Federation of Government Employees

American Federation of Musicians

American Federation of State, County and Municipal Employees

American Federation of Teachers

American Federation of Television and Radio Artists

American Guild of Musical Artists

Association of Theatrical Press Agents and Managers

Brotherhood of Railway and Airline Clerks

Communications Workers of America

Insurance Workers International Union

International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators

International Association of Machinists

International Brotherhood of Electrical Workers

International Chemical Workers Union

International Federation of Professional and Technical Engineers

International Union of Electrical, Radio and Machine Workers

International Union of Operating Engineers

National Association of Broadcast Employees and Technicians

Office and Professional Employees International Union

Retail, Wholesale and Department Store Union

Screen Actors Guild

Service Employees International Union

Seafarers International Union

United Association of Journeymen Plumbers

United Food and Commercial Workers

Policy Statement of the

Department for Professional Employees

P-7

WORKING WOMEN

Background:

Women comprise approximately 42% of the labor force, yet on average, they earn far less than their male counterparts. Women are offered less opportunities for promotion, and suffer greater unemployment rates than men.

The overwhelming majority of women workers use their incomes to support their families. These families need adequate incomes just as much as families whose income is provided by a male worker.

Women have special concerns, especially regarding job opportunities and promotion, maternity benefits, child care facilities, etc., yet less than twenty percent of working women are in the trade union movement.

Sex discrimination probably accounts for the unusual concentration of women in certain occupations and job situations. More than one-third of working women are employed in just seven occupations - secretarial, teaching, nursing, sales, general household, bookkeeping, and waiting on tables.

More than one-half are employed in jobs where 70% or more of the workforce is composed of women. Such concentration makes it easy for employers to lower pay scales since there is an overabundance of available workers.

More than one-third of all mothers with pre-school children are employed or seeking a job. The mother's availability to work is conditioned on her ability to place her pre-school children with competent baby sitters or at a good day care center.

More than a glorified baby sitter is required. Good centers look to the total development of children, employ experts in crucial early childhood education, keep staff-children ratios low and thus expenses can climb quickly. Plainly, there is urgent need for expanded government-subsidized day care centers for all employed

mothers who cannot find suitable care at a bearable price.

Policies:

The Department for Professional Employees shall work to insure that female employees are accorded the same opportunities as men to enter the professions, progress according to their abilities and make full use of their talents and skills.

DPE supports the efforts of the Coalition of Labor Union Women to organize women in the work force, and bring women into a position of equality at the workplace. The Department will work to encourage greater participation by women in the union movement.

DPE shall seek to ensure adequate child care facilities for America's working families by pressing for more federal and state aid for quality child care centers.

The Department shall undertake an educational program through conferences, publications and other appropriate means to inform the general public and professional women of the factors working against full opportunities for women employees such as the lack of child care services and maternity leaves, insistence by employers on mandatory overtime, discrimination in hiring, pay and advancement and the development of methods through collective bargaining, legal and legislative action for overcoming these obstacles.

The Department endorses the Equal Rights Amendment to the U.S. Constitution as a step toward bettering the conditions of women in the American workforce.

The Federal government shall make available resources to develop and expand day care centers to the extent that they are readily available to virtually every pre-school child of a working mother. Congress, in considering the array of proposals before it, should enact legislation to guarantee that high standards are set and enforced, and that day care expansion becomes a wholesome spur to the whole neglected field of early childhood education.

WOMEN IN THE PROFESSIONAL LABOR FORCE

A closer look at women professionals is in order for two reasons. First, women are increasingly important in the American labor force. And second, in some cases women are the main component of the professional work force. In the years 1950-74, the number of women workers grew from 29% to 39% of the labor force, and today make up 41.1% of all workers. Likewise, women have clustered in white collar jobs, as Table 9 demonstrates.

TABLE 9

U.S. LABOR FORCE, 1962 and 1978
(by sex and %)

	Female		Male	
	1962	1978	1962	1978
White Collar	55.1	62.7	38.0	40.7
Professional/ Technical	12.5	16.0	11.2	14.8
Managers/Administrators	4.8	6.0	14.1	13.6
Clerical	30.4	34.0	6.9	6.3
Sales	7.4	6.7	5.8	6.0
Blue Collar and Other	44.9	37.3	62.0	59.3
Craftsmen/ Foremen	1.0	1.7	19.1	20.9
Operatives	14.6	11.9	18.9	17.5
Service	15.2	18.0	6.5	8.5
Private Household	9.8	2.9	.1	--
Others	4.3	2.6	17.2	12.2

source: Bureau of Labor Statistics

By 1978 almost 63% of all women workers were in white collar occupations, including a large number in clerical jobs, compared to about 41% of all men. Among professional and technical workers specifically, women comprised 42.9% of the total.

TABLE 10

PROFESSIONAL LABOR FORCE, 1978

	Number (in millions)	Per Cent
Men	8.19	57.1
Women	6.17	42.9

source: Bureau of Labor Statistics

TABLE 11

PROFESSIONAL AND TECHNICAL WOMEN, 1959 & 1978

	Number (in millions)		
	1959	1978	% increase
Women in Labor Force	21.2	38.5	82
Professions/Technical Women	2.56	6.17	141

source: 1975 Handbook on Women Workers and Bureau of Labor Statistics

In the last twenty years the number of professional women has risen sharply (141%) while their number in the labor force increased by 82%. This tremendous growth is directly related to the expansion of educational and health services in the last two decades. For as Table 12 shows, women still tend to congregate in professions such as teaching and nursing which have traditionally been reserved for them. The four occupations marked with an asterisk accounted for more than 3/4 of all women professionals in 1973. Elementary

and secondary school teachers alone made up almost one-half of all women in professional occupations, while nurses represented roughly 20%.

TABLE 12

WOMEN IN SELECTED PROFESSIONS, 1973

Occupation	Number (in thousands)	% of Total in Profession
Accountant	162	21.6
Computer Specialists	56	19.5
Engineers and Scientists	87	10.7
Health Technologists*	236	71.5
Librarians, Archivists*	133	82.1
Personnal and Labor Relations	104	33.7
Physicians	42	12.2
Registered Nurses*	805	97.8
Social Workers	161	60.8
Teachers (college and university)	133	27.1
Teachers (except college and university)*	2,038	69.9
Writers, Artists, Entertainers	313	33.7
Total	4,270	

source: 1975 Handbook on Women Workers

Just as sex stereotyping has, in the past, steered women into particular professions, so too has it blunted the earning power of women workers. As Chart 11 shows, women in the professions do better relative to men than in other occupations, but even among professionals, female earning power has not necessarily improved uniformly. Since peaking in 1971, median income for professional women as per cent of male professional earnings fell below 1962 levels by 1973 (Table 13). More recent information might show renewed improvement, but the basic fact remains that women's earnings lag behind those of men.

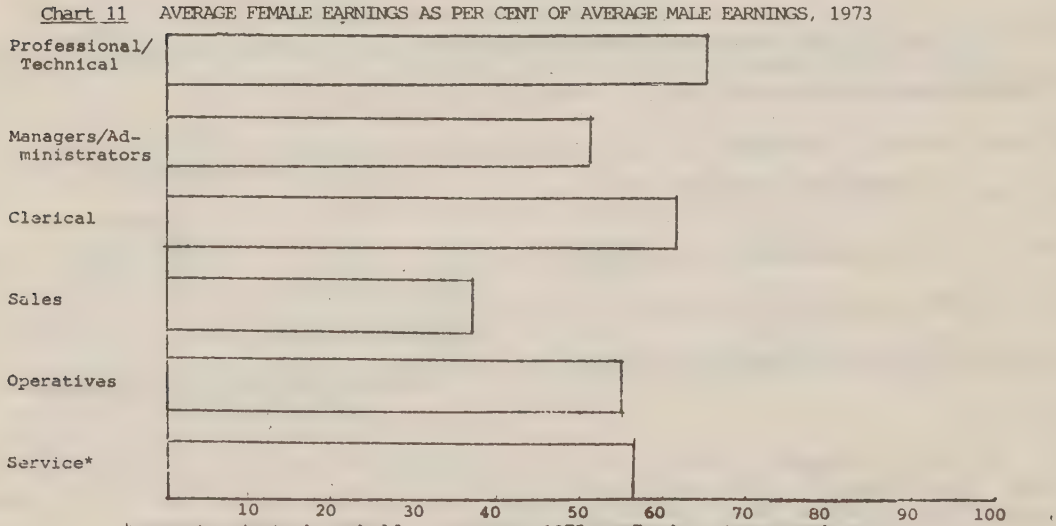
TABLE 13

MEDIAN EARNINGS OF PROFESSIONAL WOMEN
AS PER CENT OF PROFESSIONAL MEN, 1962-73

1962	66.1
1967	66.2
1971	68.6
1973	63.6

source: 1975 Handbook on Women Workers

Chart 11 AVERAGE FEMALE EARNINGS AS PER CENT OF AVERAGE MALE EARNINGS, 1973



* except private household source: 1975 Handbook on Women Workers

Organization

Increased participation in the labor force has brought more women into labor unions. By the mid-1970's, women accounted for one-quarter of all union and association members. That is, about six million women were covered by collective bargaining agreements. Women who have joined unions have found that collective bargaining gives them job security and increases their wages and salaries. A 1970 study showed that female white collar union members earned 10-20% more, on the average, than female non-union white collar workers. The same study showed that in private industry, non-union male white collar workers earned an average of 60-100% more than non-union female white collar employees. But among union members the difference was much smaller (50-60%) (Monthly Labor Review, May 1974). Though disparities continue to exist, unions do a better job of improving earnings for women than does the marketplace.

The Future

As professionals, women face special problems. Not only must they overcome income discrepancies, but their concentration into a few occupations would prove disastrous if it continued. Opportunities for school teachers, especially, are narrowing as demographic change forces a decline in school populations. On the brighter side, jobs in health will expand as the population ages and as the society demands more medical services. However, unless women succeed in overcoming the barriers to entry into other professions, a troubled economy could force many into lower skilled jobs, or out of the labor force entirely.

Some shifts to non-traditional occupations for women have already occurred, though still in small numbers. Between 1960-1970, women in engineering nearly tripled from 7,000 to 20,000 (or at a rate 4½ times that of men). In the same period, women doubled their proportion of lawyers (2.4% to 4.7%). Table 14 indicates some of those changes. In the traditionally male professions, more and more women have received training. But compared to their representation in other professions and in the labor force, women remain well behind men in numerous occupations.

TABLE 14
WOMEN EARNING FIRST PROFESSIONAL DEGREES, 1960-73 (selected fields)

Year	Architecture		Dentistry		Engineering		Law		Medicine		Optometry		Pharmacy		Veterinary Medicine	
	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent
1960 . . .	. 57	3.3	26	0.8	145	0.4	241	2.7	394	5.9	4	1.2	416	13.5	18	2.2
1961 . . .	. 60	3.7	19	.6	134	.4	262	2.8	338	5.1	4	1.3	390	12.6	16	2.0
1962 . . .	. 55	3.2	20	.6	125	.4	294	3.2	392	5.8	5	1.8	459	14.1	21	2.6
1963 . . .	. 88	4.5	27	.9	130	.4	327	3.3	405	5.9	3	.8	538	14.8	24	3.0
1964 . . .	. 78	3.9	14	.4	159	.5	343	3.2	432	6.3	5	1.7	[1]254	24.2	32	3.9
1965 . . .	.108	5.5	23	.7	139	.4	404	3.5	478	7.0	8	2.1	490	16.6	35	4.1
1966 . . .	.103	4.6	35	1.1	146	.4	518	3.9	516	7.2	3	.8	536	16.6	52	6.0
1967 . . .	.115	4.2	36	1.1	186	.5	612	4.2	574	8.0	13	3.1	558	17.4	52	5.8
1968 . . .	.126	4.5	53	1.6	211	.6	712	4.3	634	8.6	11	2.5	640	18.9	86	8.7
1969 . . .	.143	4.5	37	1.1	313	.8	755	4.4	619	8.3	8	1.8	692	20.2	67	6.2
1970 . . .	.204	5.5	36	1.0	338	.8	878	5.9	[2]713	9.3	23	5.5	853	28.1	90	8.1
1971 . . .	. . .	. . .	. . .	. . .	353	.8	. . .	. . .	[2]827	9.2	. . .	. . .	.876	25.2	88	9.4
1972 . . .	. . .	. . .	.50	1.3	493	1.1	1,573	. . .	[2]860	9.0	. . .	. . .	.997	29.2	106	11.0
1973 . . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	.910	9.1	. . .	. . .	. . .	. . .	.126	13.6

[1] Reflects transition from 4- to 5-year curricula.
[2] Data from W.F. Dube, "Women Students in U.S. Medical Schools: Past and Present," Journal of Medical Education, February 1973, pp. 186-89, table 1. Data for 1973 estimated by W.F. Dube.

Note: Percent refers to women as percent of total earning degrees. Dashes indicate data not available.

Sources: Data for 1960-70 from U.S. Office of Education. Date for 1971-73 from unpublished data from the various sources cited in table 1 and from personnel of the various professional associations.

For Further Reading

R. Blitz, "Women in the Professions, 1870-1970," Monthly Labor Review, (May 1974).

J. Parrish, "Women in Professional Training," Monthly Labor Review, (May 1974).

Department of Mathematics

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March 13, 1980

Dr. Robert Knouss
Professional Staff Member
Subcommittee on Health and Scientific Research
Committee on Labor and Human Resources
U. S. Senate
Washington, D. C. 20510

Dear Bob:

Thank you for sending me a copy of the revised Senate bill 568. As you know, I submitted testimony last August on the bill which had been introduced in the Senate in March 1979. That testimony was in my position as Chair of the American Mathematical Society, Mathematical Association of America, and the Society for Industrial and Applied Mathematics Committee on Women in Mathematics. Since that time the National Council of Teachers of Mathematics has become a co-sponsor of this Committee. I am now sending testimony regarding the revised bill in the same capacity as last August, except that NCTM is included now.

I would like to congratulate you and your staff on the revised bill. The statement of facts re women in the sciences is a very good and correct one. I like the declaration of purpose of the bill. I am pleased to see most of the bill's provisions are for "action", to encourage women to become scientists and to remain in their fields, rather than for research into why there are so few women scientists, as so much of the federal monies in the past have been spent. I believe that all women scientists are in agreement that if discrimination against women is eradicated, then there will be more women scientists. I was particularly pleased to see under Statement of Policy that one of the provisions of the bill is the participation of professional associations and groups with expertise in the advancement of women in science and technology in policy making. These are the groups most able to identify the problems women face in science, and to make recommendations for their solutions. I was also pleased to see the bill includes a suggestion that provisions be made to encourage opportunities for accomplishing comprehensive and long-term institutional change relating to the participation of women in science.

It is good to see the bill aimed at attacking the lack of women in science careers in the elementary and secondary schools, and to include programs aimed at parents. Many of the discriminations against women in the sciences are already felt by women students before they enter college. At present, unfortunately, discrimination against women in science

continues through college, graduate school, and into the work force.

I am confident that the other members of the Committee on Women in Mathematics join me in gratitude at seeing in the bill provisions for traineeships and fellowships for women in science and for the awarding of graduate and postgraduate fellowships at all levels, for emphasis on helping the continuing education woman who wishes a career in the sciences, and for changing the present images in textbooks and in the eye of the public that science is not for women. The incentive awards to high schools which can prove that they encourage their female students, as they do their male students, to enter careers in the sciences is good. It also hits high schools at just a point where funds in all communities are low. That may end by being a help in this connection although one always wishes for the maximum of funding for education.

It is particularly gratifying to see the provision for a Committee on Women in Science, with the charge of working with and advising the National Science Foundation. That latter can stand a lot of advising on the use of its funds for women in science. I was glad to see the provision that of a 13 member Committee at least 9 must be women, with 7 of those holding the Ph.D. degree in the disciplines. The provision that the Committee will advise on peer review procedures and on the choice of advisory committees is a good one. As you are aware, most of the women's caucuses in the sciences feel strongly that these two aspects of the present workings of the NSF are far from satisfactory.

I would be happy to see travel grants for young women scientists, particularly those with positions in institutions which have a small amount of money for travel grants, included in the provisions of the bill. Perhaps that could come to pass under recommendations to the NSF from the Committee on Women in Science.

I think the GS-18 pay for the advice and work of women in science who are at the level in their own careers where they could be expected to give valuable advice to the National Science Foundation is appropriate. After all, these women will have spent many years as women scientists, facing discrimination on many occasions, and their advise should be invaluable.

Thank you and your Committee again for all its work on behalf of Senate bill 568. I wish you success in its quick passage through the Senate.

Sincerely,

Alice

Alice T. Schafer
Helen Day Gould Professor of Mathematics
Chair, AMS-MAA-NCTM-SIAM Committee on
Women in Mathematics

ATS/et

Senator METZENBAUM. Thank you all very much. The hearing has been extremely helpful.

[Whereupon, at 11:48 a.m., the subcommittee was adjourned.]

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